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THE STUDENT'S CHEMICAL POCKET COMPANION.

BY

W. S. JACOBS, M. D.

Trahit quodcunqe potest atque addit acervo.
HOR.

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TO THE GENTLEMEN

ATTENDING THE

MEDICAL LECTURES

IN THE

UNIVERSITY OF PENNSYLVANIA,

THE

FOLLOWING SHEETS

INTENDED TO FACILITATE

THEIR PROGRESS IN

THE SCIENCE OF CHEMISTRY,

ARE INSCRIBED,

BY

THEIR FRIEND,

AND WELL WISHER,

W. S. JACOBS.

PREFACE.

THE utility and neceſſity of a compendium, to facilitate the ſtudy of Chemiſtry, of a ſize and compaſs as the one I now preſent to the public, has long been acknowledged. To compriſe the eſſential information in a ſize convenient for the pocket, is attended with more difficulty than many will allow. The following ſheets may probably merit the attention of the ſtudents in this univerſity, as they contain a detail of many original and uſeful experiments, as performed by the profeſſor of Chemiſtry, Dr Woodhouſe.

I have not aimed at any thing elaborate: intending it principally for the Tyro in Chemiſtry, I have ſelected, and thrown together in as compendious a manner as poſſible, what is eſſentially, indeed indiſpenſibly requiſite, to be known by him.

The various and intereſting ſubjects of this ſcience require, in a minute inveſtigation, the aid of volumes; but the Student, too frequently damped in the commencement of his career, by the proſpect of labour before him, turns from the volumes with diſguſt, and relinquiſhes the purſuit, before he can become intereſted in the ſubject, or capable of appreciating its advantages. A volume of this ſize is calculated to allure him into the path of ſcience, by diverting the mind, and exciting in it the ſpirit of enquiry.

This performance, as being executed in thoſe hours, which could be ſpared from a laborious employment, will, I hope meet the indulgence of the candid reader.

CHEMISTRY.

CHEMISTRY has for its object, the inveſtigation of the conſtituent principles of bodies.

This knowledge is obtained by analyſis or decompoſition, and ſyntheſis, or compoſition.

ATTRACTION, is that power, by which the particles of bodies are approximated.

There are four kinds of attraction, 1ſt, the attraction of gravitation; 2d, of coheſion; 3d, of magnetiſm; and 4th, chemical attraction.

The laws of chemical attraction or affinity are of two kinds, viz. the affinity of aggregation, and the affinity of compoſition.

The attraction of aggregation exiſts between particles of bodies ſimilar in their nature; while the attraction of compoſition, exiſts between particles which are diſſimilar.

OF CALORIC.

HEAT tends to ſeparate the particles of bodies, and antagoniſes all kinds of attraction.

When the attraction of cohesion, is in an over-proportion, bodies are solid. When caloric predominates in a small proportion, they assume a liquid form; but when in a greater degree, the body is converted into gas.

HEAT always tends to an equilibrium.

Bodies are called good or bad conductors, according to the quick or slow passage of this fluid through them.

When a body passes from a solid to a fluid state, a quantity of heat is absorbed, this heat is then in a state of combination, and is called latent heat. Bodies passing from a fluid to a gaseous state, heat is also absorbed by which they are kept in that state. When on the contrary, a body passes from a fluid to a solid state, heat is given out, which becomes sensible heat.

LIGHT.

The solar light is divisible, by the prism, into seven primitive colours, viz. red, orange, yellow, green, blue, indigo and violet.

LIGHT passing from one medium into another of different density, suffers refraction. It is also ponderous.*

* See Newton.

VEGETABLES when deprived of light, exhibit a pale colour, are inodorous, inſipid, and deprived of active qualities.

Light has great effects on chemical operations, by diſengaging oxygen from various combinations.

SULPHUR

Is a ſimple ſubſtance of an orange yellow colour, burning with a blue flame, and exhaling a ſtrong penetrating odour; by friction, it becomes electric.

It is found native, or combined with earths and metals; it is alſo obtained from certain vegetables.

FLOWERS OF SULPHUR, are obtained from crude ſulphur by ſubliming it in cloſe veſſels.

Sulphur burnt with ſubſtances, containing oxygen, forms the ſulphuric acid.

Sulphur combined with different ſubſtances, forms ſulphurets; but theſe combinations will be mentioned in their reſpective places.

CARBON.

From many experiments, it appears that the diamond, is cryſtalized carbon, or carbon in a ſtate of purity.

Plumbago is the next degree of purity, and is an oxyde of carbon.

Charcoal poſſeſſes the third degree of purity; and carbonic acid the laſt, being completely faturated with oxygen.

Plumbago is found in different parts of the world, but the beſt is found in England. It it a mixture of carbon and iron.

Charcoal is obtained from animal and vegetable ſubſtances by combuſtion. In cloſe veſſels, it reſiſts the greateſt heat; by this means it is obtained in a ſtate of purity. It readily abſorbs moiſture from the atmoſphere. Fourcroy conſiders charcoal, as an hydrogenous oxyde of carbon.

PHOSPHORUS

Is a ſubſtance of the conſiſtence of wax, of a fleſh colour, and when pure tranſparent, it is luminous in the dark and ſoluble in alkohol and the eſſential oils.

This ſubſtance was firſt obtained from urine, but is procured with greater facility from bones, as they contain the phoſphate

of lime. Theſe muſt be calcined to whiteneſs, then pulverized, and diluted ſulphuric acid thrown on them; the ſulphuric acid unites to the lime, and forms the ſulphate of lime, while the phoſphoric acid is ſet at liberty, and remains in the fluid: this is decanted, and evaporated to the conſiſtence of an extract, it then muſt be put in a crucible, and expoſed to heat, till converted into glaſs. This muſt be powdered and mixed with pulverized charcoal; it is then to be put in an earthen retort well coated with dung and clay, and expoſed to the heat of an air furnace. In this operation the oxygen of the phoſphoric acid, unites with the coal, and forms the carbonic acid, while the phoſphorus comes over in tears and phoſphorated hydrogen gas.

Phosphorus takes fire at about 100 ° of Farenheit, it then combines with the oxygen of the atmoſphere, and forms phoſphoric acid.

OF THE GASES.

Hydrogen gas is a combination of hydrogen and caloric, ſo called becauſe it is one of the conſtituent parts of water. It is obtained from ſeveral ſubſtances, but

with great facility by the decompoſition of water.

If to a piece of zinc, be added a quantity of diluted ſulphuric acid, the acid decompoſes the water; the oxygen of the water oxydes the zinc, which is diſſolved by the acid, forming a ſulphate of zinc, and the hydrogen is diſengaged. It is alſo obtained, in large quantities, by paſſing ſteam through an ignited iron tube.

If 15 parts of hydrogen, and 85 of oxygen be burnt in a cloſe veſſel, water is formed proportionally to the weight of the gaſes employed.

When this gas is obtained over mercury, it is inodorous; but when obtained over water, it contracts a diſagreeable ſmell from the water it holds in ſolution.

It is improper for reſpiration and combuſtion, unleſs in contact with atmoſpheric air. When taken into the lungs, it ſuffers no decompoſition.

It is the lighteſt of all the gaſes, a cubic foot weighing only 72 grains.

Hydrogen gas has the property of diſſolving certain ſubſtances. When combined with ſulphur, it is called ſulphurated hydrogen, or hepatic gas, which has a diſagreeable ſmell, renders white metals black, and is unfit for animal life. It may be formed by adding water to hepar ſulphuris: In this experiment, the water is de-

compoſed, the oxygen unites to part of the ſulphur, and forms the ſulphuric acid, this combines with the potaſh of the hepar, and forms vitriolated tartar, while the hydrogen of the water diſſolves the other part of the ſulphur, forming ſulphurated hydrogen gas.

With carbon, it forms carbonated hydrogen gas; this is the moſt fatal of all the gaſes.

It may be obtained by extinguiſhing ignited coals under water, and receiving the gas as it is formed.

It is alſo procured from caſt iron, and the ſulphuric acid, or from finery cinder and charcoal by diſtillation: hydro carbonate generally contains a ſmall quantity of carbonic acid, it is freed from this by waſhing it in lime-water.

With phoſphorus, it forms phoſphorated hydrogen gas: this is often ſeen in the neighbourhood of burial grounds, as the ignes fatui, &c. It is this gas that burns on the ſurface of certain ſprings.

OF OXYGEN.

Oxygen, the acidifying and putrifying principle, is found only in combination.

Oxygen gas, is compoſed of oxygen and caloric. It forms a conſtituent part of our atmoſphere, in the proportion of 28 to 100. It is the only gas proper for combuſtion and animal life: in both caſes, the oxygen is decompoſed, and ſenſible heat generated: it is alſo one of the component parts of water.

It is emitted by expoſing vegetables to the light of the ſun, under water.

It may be obtained, by decompoſing acids, of which it is the baſe.

One pound of nitre yields 1200 cubic inches of this gas, by diſtillation. In this caſe, the nitric acid of the nitre is decompoſed. It is obtained alſo in great quantities, from the black oxyde of manganeſe, by the ſulphuric acid and heat, or by expoſing the oxyde, in an earthen retort, to a red heat.

Mercurial oxydes yield large quantities of this gas, by heat only, holding a ſmall portion of mercury in ſolution.

Its ſpecific gravity exceeds that of atmoſpheric air—a cubic foot weighing 760 grains.

NITROGEN,

Or azote, is the radical of the nitric acid: it is always found in combination.

NITROGEN GAS is a combination of nitrogen with caloric. The beſt method of obtaining it, is by expoſing a quantity of atmoſpheric air, in a veſſel inverted over a liver of ſulphur or of lime: the oxygen will be abſorbed, and the nitrogen left behind; which muſt be waſhed in lime-water, to abſorb a ſmall quantity of carbonic acid, which generally exiſts in atmoſpheric air.

It may alſo be obtained by treating the muſcular parts of animals, with the nitric acid. Alſo by inverting a veſſel over a combuſtible body, the oxygen will be abſorbed during combuſtion, and the azote left behind.

This gas is improper for reſpiration and combuſtion; it is lighter than atmoſpheric air, of which it forms 72 parts in the hundred.

ATMOSPHERIC AIR

Is a mixture of 72 parts of nitrogen, and 28 of oxygen; a ſmall proportion of carbonic acid exiſts, but not as a conſtituent part.

Theſe gaſes are not in a ſtate of combination, but in a ſtate of mixture.

The gravity of the atmoſphere differs at different times, which is evinced by the barometer.

It is inviſible, inſipid, and inodorous: a cubic foot weighs 720 grains.

This gas is decompoſed, during reſpiration, part of its oxygen is abſorbed in its paſſage through the lungs: this unites to the phoſphorus of the blood, and produces the phoſphoric acid, while heat is ſet at liberty; this phoſphoric acid unites to the iron of the red globules, and produces the red colour—Another part of the oxygen combines with the carbon of the blood, and forms the carbonic acid, which is diſcharged from the lungs with a portion of atmoſpheric air, not decompoſed in the proceſs.

WATER

Is a transparent fluid, compoſed of hydrogen and oxygen, in the proportion of 15 parts of the former, and 85 of the latter.

It exiſts in moſt bodies, of the animal, vegetable, and mineral kingdoms. At 32° of Farenheit's Thermometer, water freezes; above this temperature it aſſumes a liquid form, and at 212° it is converted into vapour.

Water, when raiſed in the atmoſphere, conſtitutes clouds, fogs, miſts, rain, &c. by ſimple refrigeration.

Ice is the natural ſtate of water; the convertion of water into ice, is attended with a diſengagement of heat.

Water, in a ſolid ſtate, occupies more ſpace than in a liquid form.

Water is generally preſented to us by nature in a fluid ſtate; river, or rain-water, is never found pure, but contains ſalts, acids, &c. theſe are rendered pure by diſtillation. If water be paſſed through an ignited iron tube, it will be decompoſed, the oxygen unites to the iron, and the hydrogen eſcapes; the metal will be found to have encreaſed in weight, which if added to the hydrogen will be equal to the weight of the water employed. This experiment is one of the pillars of the new doctrine.

ALKALIES.

Alkalies have an acrid urinous taſte, turn blue vegetable colours, green (indigo and litmus excepted) effervesce with ſome

acids, and form neutral ſalts with all. They likewiſe render oils miſcible with water, forming ſoap.

ALKALIES are divided into fixed and volatile.

OF FIXED ALKALIES.

POTASH or the vegetable alkali, is compoſed of nitrogen, and a baſe, which is ſuppoſed to be lime. It is obtained from the aſhes of vegetables, and from the lees of wine; this ſalt attracts the moiſture of the atmoſphere, and is then called oil of tartar, per deliquium.

Pure potaſh is alſo obtained by fuſing nitre upon charcoal, the acid and water are diſſipated, while the alkali remains alone; this is called extemporaneous alkali.

SALT OF TARTAR is formed by calcining the tartar of wine, diſſolving the reſidue in water, and cryſtalizing it; or by burning nitre and tartar; the reſidue after lixiviation, is a beautiful ſalt of tartar.

MINERAL ALKALI.

Natron or ſoda, is found in a native ſtate, in Egypt, but is generally obtained from the aſhes of marine plants. It is ſuppoſed to conſiſt of nitrogen and magneſia, it efloreſces in the air; when pure it is leſs cauſtic than potaſh, and better for the purpoſe of making glaſs, contains in 100 parts, 16 acid, 20 alkali, and 64 of water.

Alkalies combine eaſily with ſulphur: If pure liquid alkali be digeſted upon ſulphur, the mixture becomes reddiſh, and is then called liver of ſulphur; a fœtid gas, called hepatic gas, is diſengaged. This hepar ſulphuris, or liver of ſulphur, diſſolves metals, even gold itſelf.

Vegetable and mineral alkalies have the property of forming glaſs with ſilex, and not being volatilized by heat.

AMMONIAC,

Or the volatile alkali, is compoſed of hydrogen and nitrogen, in the proportion of 193 of the former, and 807 of the latter, in the 1000: volatile alkali, is uſually obtained by diſtilling animal ſubſtances, as hoofs, horns, bones &c, this product is contami-

nated with Dipple's animal oil; it is alſo obtained from certain vegetables. Very pure ammoniac may be obtained by mixing equal parts of ſal ammoniac, and quicklime in powder; this is put into a flaſk, to which a ſyphon is adapted; being expoſed to heat, the volatile alkali comes over, and is received in veſſels containing water, until fully ſaturated; the muriatic acid of the ſal ammoniac unites to the lime, and forms muriate of lime, while the ammoniac is diſengaged in the form of alkaline gas, which is abſorbed by the water, forming the cauſtic ammoniac.

Alkaline gas, is a combination of ammoniac and caloric; it is improper for reſpiration and combuſtion, and is lighter than atmoſpheric air.

By mixing this gas with the oxygenated muriatic acid; water is produced. This is effected by the union of the oxygen of the acid, with the hydrogen of the alkali, while the azote is ſet at liberty, and the oxygenated acid is reduced to the ſtate of common muriatic acid.

OF ACIDS.

Acids are formed by the combination of oxygen with certain baſes.

Acids have a ſour ſtiptic taſte; effervefce with alkalies, and change blue vegetable colours, red, indigo excepted.

THE SULPHURIC ACID, is obtained by burning ſulphur with a ſubſtance containing oxygen; nitre is generally uſed for this purpoſe—100 parts of this acid contain about 70 ſulphur and 30 oxygen. When this acid is mixed with water, it produces heat ſufficient to make water boil. It attracts water from the atmoſphere, and congeals by intenſe cold—If any combuſtible body is immerſed in the acid, this laſt is changed into the ſulphureous by parting with its oxygen. If more oxygen is abſtracted, it will be converted into ſulphureous gas.

SULPHURIC ETHER is made by diſtilling together equal parts of ſtrong ſulphuric acid, and alkohol. The firſt product is ſpirit of wine, the ſecond ether, the third is a ſubſtance called ſweet oil of wine; and a black matter reſembling tar, is left in the retort.

HOFMAN'S ANODYNE DROPS, is a mixture of ether, alkohol, and a ſmall quantity of the ſweet oil of wine.

If the ſulphuric and muriatic ethers be mixed together, the evaporation is ſo rapid that mercury has been frozen by the degree of cold thus produced.

SULPHURIC ACID, united to certain bafes, forms falts, called fulphates.

SULPHATE OF SODA, or Glauber's falt is obtained in different ways; but a very economical procefs of forming Glauber's falt, is by adding the fulphate of ammoniac, in folution, to the muriate of foda; here a double elective attraction takes place, the fulphuric acid unites to the foda, forming fulphate of foda, while the muratic acid unites to the ammoniac, forming muriate of ammoniac; thefe falts are then cryftalized, and expofed to heat in a clofe veffel; the muriate of ammoniac fublimes, and the Glauber's falt is left pure: this is to be diffolved and cryftalized.

The fulphate of ammoniac, for this experiment, is obtained by decompofing the fulphate of lime, by means of the carbonate of ammoniac, obtained by the diftillation of bones.

Glauber's falt contains 27 of acid, 15 of alkali, and 58 of water, in 100 parts, it effloreſces in the air, has a bitter urinous taſte, and is foluble in its own weight of boiling water

SULPHATE OF POTASH or vitriolated tartar: 100 parts contain 30.21 of acid, 64.61 of alkali, and 5.18 of water. It has a penetrating taſte, becomes red-hot before it fufes, and is volatilized without decompofition. Thefe falts fuperfaturated with the

acid, are called acidulous ſulphates of potaſh or of ſoda.

SULPHATE OF AMMONIAC has a bitter taſte: barytes and lime decompoſe it: it contains 42 of acid, 40 alkali, and 18 of water, in the 100.

SULPHATES, with earthy baſes—

SULPHATE OF LIME, gypſum, or plaſter of Paris—100 parts contain 32 of lime, 46 of acid, and 22 of water.

SULPHATE OF MAGNESIA, or epſom ſalt, it contains 24 of acid, 19 of magneſia, and 57 of water: it is found in mineral waters; from which magneſia is obtained, by adding fixed alkali to its ſolution: the earth is precipitated, in the ſtate of a carbonate.

SULPHATE OF ALUMINE, or alum: 100 parts contain 38 of acid, 18 of earth, and 44 of water. If alum be expoſed to heat, and the water of cryſtalization be driven off, it becomes cauſtic, and is then called burnt alum. The alum of commerce contains a ſmall portion of potaſh.

PYROPHORUS is made by taking three parts of burnt alum and one of ſugar, or

honey; this is to be expoſed to heat in a crucible, until it becomes black; it is then to be put in a phial, coated with a mixture of horſe-dung and clay; then placed in a crucible, ſurrounded with powdered charcoal, and again expoſed to heat, till a blue flame appears.—A pyrophorus may be made by rubbing together 54 grains of ſulphur 36 of willow charcoal, and 3 of phoſphorus.

Pyrophorus inflames when in contact with atmoſpheric air.

Sulphate of strontites is inſipid, and ſcarcely ſoluble in water.

Sulphate of barytes, or ponderous ſpar: 100 parts contain 30 of acid, 67 of barytes, and 3 of water; when heated, it becomes luminous, and is called Bolognian phoſphorus.

Nitric acid is compoſed of about 80 of oxygen, and 20 of azote or nitrogen; it always exiſts in a ſtate of combination: it is uſually obtained by diſtilling nitre with a quantity of powdered flints; ſome of the other earths have alſo the property of decompoſing this ſalt. It may be obtained by diſtilling nitre with the ſulphuric acid; or a mixture of nitre and ſulphate of iron.—The ſulphuric acid unites to the potaſh,

and forms vitriolated tartar; while the nitric acid is difengaged in yellow fumes.—The nitric acid thus obtained, contains a fmall quantity of fulphuric or muriatic acid; it is cleared from the fulphuric by re-diftilling it from frefh nitre; and from the muriatic, by the addition of the nitrate of filver—the muriatic acid unites with the filver, and luna cornea, is precipitated.

Nitric acid, acts on many of the metals, producing nitrous gas—When mixed with oils it inflames, or renders them black. If nitric acid be poured on finely powdered charcoal, or lampblack, the mixture will take fire; carbonic acid, and nitrous gas, being produced.—For this experiment the acid fhould be concentrated.

NITROUS ETHER, is made by diftilling equal parts of nitric acid, and alkohol.

SPIRITUS NITRI DULCIS, is formed by diftilling three parts of alkohol, and one of nitrous acid.

NITROUS ACID, is fuppofed to exift in three ftates: the bright yellow, containing 2.344 of oxygen; the orange coloured 2.292, and the dark green 2.230, to 1 of nitrogen.

NITROUS GAS, is compofed of 56 parts of oxygen, and 44 of nitrogen, in 100—it is

invifible, and lighter than atmofpheric air ; improper for refpiration and combuftion, and is neither acid, nor alkaline: but when it combines with the oxygen of the atmofphere, it forms the nitric acid; from this property it has been ufed to afcertain the purity of the atmofphere, by means of the eudiometer; this procefs however, is fallacious.

Nitrous gas may be procured by decompofing the nitric acid, with combuftible fubftances. The beft method of obtaining this gas, is by expofing copper in a phial, adding a folution of nitre ; and then pouring on the fulphuric acid—In this experiment, the fulphuric acid unites to the potafh of the nitre, and forms vitriolated tartar ; the nitric acid being difengaged, attacks the copper, and is in part decompofed, a portion of its oxygen, oxyding the copper, while another unites to the nitrogen forming nitrous gas, which is given over.

Nitrous oxyde—The gafeous oxyde of azote, of Dr. Mitchill, or the dephlogifticated nitrous air of Dr. Prieftly, is a lower degree of oxydation, than nitrous gas, it confifts of 37 of oxygen, and 63 of azote. The oxygen appears to exift in a much weaker ftate of combination, in this than in the nitrous gas. Inhaled, when mixed with

atmoſperic air, it induces hilarity, &c. It differs from nitrous air, in being abſorbed by water, and in ſupporting combuſtion; a taper burning nearly as vividly in this, as in oxygen gas, and in contact with oxygen, it does not form the nitric acid. It is obtained from tin, and the nitric acid: (*see tin*) but the beſt method is by means of the nitrate of ammoniac; this nitrate is formed by adding the nitrate of potaſh to a ſolution of the ſulphate of ammoniac; here a double elective attraction takes place, the ſulphuric acid of the ſulphate of ammoniac, unites to the potaſh and forms the ſulphate of potaſh, or vitriolated tartar, while the nitric acid of the nitre unites to the ammoniac, and forms the nitrate of ammoniac, which remains in the ſupernatant liquor, after the vitriolated tartar is cryſtalized; and by evaporation the nitrate of ammoniac is obtained in cryſtals; this nitrate is then expoſed to heat in a retort, and nitrous oxyde is given out in large quantities.

Dr. Mitchill, employs the terms ſeptic acid, for nitric acid; ſeptous acid, for nitrous acid; ſeptic gas, for nitrous gas; ſeptous gas, for nitrogen gas; and ſepton, for nitrogen.

He ſuppoſes that ſepton, chemically united to oxygen, before it has taken on the form of a gas, to conſtitute the matter of peſtilence.

NITRATES, are neutral ſalts, compoſed of nitric acid, and certain baſes.

NITRATE OF POTASH, is formed by a direct combination of the nitric acid, and potaſh. This ſalt leaves a ſenſe of coldneſs in the mouth; if thrown on ignited coals, its acid is decompoſed, the oxygen unites to the coal, and forms the carbonic acid: its nitrogen and water being diſſipated, and pure potaſh remains behind. It exiſts ready formed in the earth, as in burial grounds, &c.—It is alſo obtained from the plaſter of old houſes. In ſome places it efflorefces on the ſurface of the earth, exiſts in ſome vegetables, and is produced in the proceſs of putrefaction.—the nitrogen of the animal ſubſtance, unites to the oxygen of the atmoſphere, and forms the nitric acid; this unites with an alkaline baſe, produced by vegetable decompoſition, and forms nitre—100 parts contain 30 acid, 63 alkali, and 7 water.

CRYSTAL MINERAL, or ſal prunel, is formed by fuſing nitre, and driving off its water of cryſtalization.

SAL POLYCREST, is produced by mixing equal parts of nitre, and ſulphur, in a red-hot crucible.

GUN POWDER, consists of 75 parts of nitre, 16 of charcoal, and 9 of sulphur.

FULMINATING POWDER is formed by triturating, 3 parts of nitre, 2 of salt of tartar, and 1 of sulphur. This put on a shovel and heated, detonates with violence; previous to the explosion, the sulphur unites to the potash, forming hepar sulphuris, which gives out sulphurated hydrogen gas; this unites to the oxygen of the nitre, and is set on fire by the heat applied.

NITRATE OF SODA or cubic nitre, is a salt formed by the nitric acid and soda; it is never found in a native state, it has a cool and bitter taste; this salt contains the strongest nitric acid, according to Kirwan. It consists of 28.80 of acid 50.09 of alkali, and 21,11 of water.

NITRATE OF AMMONIAC is formed by adding nitre to a saturated solution of sulphate of ammoniac; this must be twice evaporated, at the temperature of 250 °— it deposits the sulphate of potash, leaving nitrate of ammoniac in solution, which at 212 ° crystalizes in needles. It is also produced by uniting volatile alkali, with nitrous acid vapours.

NITRATES with earthy bafes.

NITRATE OF LIME is fometimes found adhering to lime ftone, alfo in fpring water or in the lixivium of old plafter, it is a very deliquefcent falt—100 parts contain, 43 acid, 22 lime, and 35 water—When expofed to heat, it parts with its acid, in the form of nitrogen and oxygen gafes: The refidue is Baldwin's phofphorus. A folution of this falt in alkohol, burns with a red flame.

NITRATE OF BARYTES is the production of art, alkalies do not decompofe it, it is an excellent teft for the fulphuric acid; fulphate of barytes being precipitated; by expofing this falt to a violent heat, pure or highly cauftic barytes remains; a folution of this falt in alkohol, burns with a pale yellow flame.

NITRATE OF MAGNESIA is found in the walls of old buildings, &c. it is acrid, bitter and deliquefcent. It is decompofed by lime, the alkalies &c. 100 parts contain 36 of acid, 27 of magnefia, and 37 of water.

NITRATE OF ALUMINE is aftringent to the tafte, and deliquefcent: alkalis, magnefia and lime decompofe it.

NITRATE OF STRONTITES forms octahedral cryſtals, and gives a carmine red flame to alkohol.

NITRITES are neutral ſalts, formed by nitrous acid, and certain baſes: to which very little attention has been paid.

MURIATIC ACID, has been ſuppoſed by ſome gentlemen, to be compoſed of hydrogen and oxygen—and Mr. Lamb thought that ſulphurated hydrogen, was the baſe of this acid!!!

It is obtained by diſtilling common ſalt, and the ſulphuric acid—the ſulphuric acid combines with the ſoda, and forms Glauber's ſalt, while the muriatic acid is given over.—It has a ſtrong ſaffron-like ſmell, and is lighter than the ſulphuric and nitric acids.—It emits white vapours, which are rendered more viſible, if in contact with volatile alkali, ſal ammoniac being formed.

MURIATES are neutral ſalts, formed by the muriatic acid, and certain baſes.

MURIATE OF POTASH, or febriſuge ſalt of Sylvius—is found in ſea water, and in animal and vegetable fluids. It has a ſtrong

bitter taſte, it contains 29.68 of acid, 63.47 of alkali, and 6.85 of water.

MURIATE OF SODA, or common ſalt, is found in mines, in ſeveral parts of the world, by the drying up of ſalt lakes, &c. it is alſo obtained from ſea-water, by evaporation, &c. It decripitates in the fire, is volatilized without decompoſition; and aſſiſts the fuſion of glaſs. It contains 43 acid, 46 alkali, and 11 of water in 100.

SODA is obtained from common ſalt, by the addition of the acetate of lead, the muriatic acid of the ſalt unites with the lead, forming a muriate of lead; while the ſoda combines with the vegetable acid, from which it muſt be ſeparated by evaporation and calcination: it is alſo decompoſed by potaſh and barytes.

It is ſaid that common ſalt contains a ſmall quantity of mercury, in the ſtate of corroſive ſublimate.

MURIATE OF AMMONIAC, or ſal ammoniac, is found native in many places, but particularly in the neighbourhood of volcanos: It is generally brought to us from Egypt, where it is obtained by diſtillation from the ſoot of the dung of animals, feeding on ſaline vegetables. It ſometimes exhales from the human body in malignant fevers. It contains 52 parts of acid, 40

ammoniac, and 8 of water, in 100: it is ductile under the hammer, and does not change when expoſed to the air. It is decompoſed by lime and the fixed alkalies: in this proceſs the ammoniac is diſengaged, leaving an alkaline muriate, or muriate of lime. If the lime, or alkali, be pure, cauſtic ammoniac is produced; but if carbonates are employed, the carbonate of ammoniac is the reſult.

Muriate of lime is found in mineral waters, particularly in ſea-water; it is very deliqueſcent, and of difficult cryſtalization: 100 parts of lime take up 86 of acid—It may be formed by ſaturating marine acid with lime: When fuſed, it is called Homberg's phoſphorus. Muriate of lime is alſo formed, by mixing lime and the muriate of ammoniac in ſolution; the ſal ammoniac is decompoſed, the muriatic acid unites to the lime, and forms muriate of lime, while the ammoniac is ſet at liberty: the liquor is to be evaporated and cryſtalized. If a ſtrong ſolution of this muriate be mixed with the concentrated ſulphuric acid, the mixture will put on a ſolid form.

If the cryſtalized muriate of lime be mixed with ſnow, the cold it produces is ſo intenſe, as to freeze mercury.

MURIATE OF MAGNESIA exiſts in ſea-water, and in the mother waters of ſalt-works; it it an acrid, bitter, and deliqueſcent ſalt: 100 parts contain 34 acid, 41 magneſia, and 25 of water.

MURIATE OF BARYTES has never been found native: pure alkalies and earths have no effect on this ſalt (to obtain it, *see barytes.*) It is an excellent teſt for the ſulphuric acid.

OXYGENATED MURIATIC ACID is formed by diſtilling the muriatic acid with the metallic oxydes—For this purpoſe, the black oxyde of manganeſe may be uſed.

If a quantity of common ſalt and manganeſe are put in a retort, and ſulphuric acid added; a portion of the acid decompoſes the ſalt, and forms Glauber's ſalt, and the muriatic acid is ſet at liberty; while the other portion of the ſulphuric acid, acting on the manganeſe, drives over the ſuperabundant oxygen, to which the muriatic acid unites, and paſſes over in the ſtate of oxygenated muriatic acid—It may alſo be formed by adding ſimply the muriatic acid to an oxyde.

It has a ſtrong penetrating ſmell, and acts poſitively on the trachea. It has the property of deſtroying colours in moſt ſubſtances, and when expoſed to light, loſes its

oxygen; in both of which proceſſes it is converted into the common muriatic acid.

From the property of deſtroying colours, it is uſed in bleaching of linnen, cotton, ſilk, wax, &c. for theſe purpoſes it is mixed with alkohol: When mixed with minium, or red lead, it is uſed to deſtroy the colour of common ink, but does not act on printer's ink.

This acid, in a ſtate of gas, inflames many combuſtible ſubſtances, in a ſtate of diviſion; as gold, antimony, biſmuth, zinc, cinnabar, charcoal, ſulphur, phoſphorus, &c. The oxygen of the gas unites to the combuſtible ſubſtance, and heat and light is given out.

OXYGENATED MURIATIC ACID GAS may be obtained in large quantities, by adding the muriatic acid to the black oxyde of manganeſe, and applying heat.

Seeds have been made to vegetate, by putting them in a paſte made with the black oxyde of manganeſe, and the oxygenated muriatic acid.

OXYMURIATES are ſalts, formed by the combination of the oxygenated muriatic acid and certain baſes.

Oxymuriate of potah is obtained by ſaturating a ſolution of cauſtic alkali, with this acid; by evaporation, cryſtals of an argantine brilliancy are depoſited; with this oxymuriate, two other ſalts are alſo formed—the hyperoxygenated muriate, and the common muriate of potaſh, differing in the form of their cryſtals. The hyperoxygenated muriate of potaſh contains the greateſt quantity of oxygen, of any known ſubſtance, and from it the pureſt oxygen is obtained; 100 grains yielding 75 cubic inches.

If a very ſmall quantity of this ſalt be triturated with ſulphur, it explodes loudly. If, inſtead of nitre, this ſalt be uſed in the formation of gun-powder, its effects will be much augmented.

Oxymuriate of soda is obtained in the ſame way as the above ſalt; and has nearly the ſame properties.

Of the other oxymuriates little has been aſcertained.

Nitro muriatic acid, or aqua regia, is formed by diſtilling two parts of nitric acid, and one of muriatic together: it is alſo formed by diſſolving four ounces of ſal ammoniac in a pound of nitric acid. It is ſaid that the nitric acid, in this experiment, attacks the ſal ammoniac, and diſplaces the

muriatic, which combines with a portion of the oxygen and nitrous gas of the nitric acid. It is alſo formed by mixing the two acids together.

The nitro muriatic acid diſſolves metals, and is the true ſolvent of gold: its ſpecific gravity is leſs than that of the two acids made uſe of.

Carbonic acid, or fixed air, is found in three different ſtates; viz. in a ſtate of gas, as in wells, tombs, cellars, &c.—in a ſtate of mixture, as in mineral waters—and thirdly, in a ſtate of combination, as in limeſtone, &c. It is procured in its gaſeous form, by adding the ſulphuric acid to limeſtone, or chalk: The ſulphuric acid unites with the lime and forms gypſum, while the carbonic is diſengaged.

This gas is alſo formed in the proceſſes of combuſtion, reſpiration, and vinous fermentation. It appears to conſiſt of 28 parts of carbon, and 72 of oxygen, with a portion of caloric.—The properties of this gas, are—it is heavier than atmoſpheric air, conſequently occupies the loweſt ſituations, and may be poured from one veſſel into another—It turns blue vegetables red, forms neutral ſalts with the alkalies, is abſorbed by water, is unfit for reſpiration or combuſtion, and precipitates lime-water, &c.

Carbonates are neutral falts, formed by the carbonic acid, and certain bafes.

Carbonate of potash, or cretaceous tartar, is formed by faturating a folution of potafh, with the carbonic acid, and cryftalizing it: This falt efflorefces; by heat it is converted into pure alkali, and is then deliquefcent.—Lime and all the acids decompofe it: 100 parts contain 20 acid, 48 alkali, and 32 of water.

If to a folution of carbonate of potafh, lime be added, the carbonic acid of the potafh unites with the lime, forming a carbonate of lime, and the alkali will be rendered cauftic: the clear liquor muft then be decanted, and kept in clofe bottles; if evaporated, fufed, and caft into moulds, the lapis caufticus is obtained.

Carbonate of soda, or cretaceous foda, effloreſces in the air; 100 parts contain 16 acid, 20 alkali, and 64 of water; it is decompofed by heat, lime, phofphorus and the acids—It has greater affinity with filex than the former; in conſequence of which it is better calculated for vitrification.

Carbonate of ammoniac, or concrete volatile alkali—is formed by paffing carbonic acid through a faturated folution of ammoniac: or by expofing ammoniac to an

atmoſphere of carbonic acid—It is alſo obtained from animal ſubſtances by diſtillation; but the beſt method for obtaining it, is by decompoſing the muriate of ammoniac; for this purpoſe, pulverized ſal ammoniac and chalk, are to be mixed together, put in a retort, and expoſed to a low degree of heat: a double elective attraction takes place, the muriatic acid of the ſal ammoniac unites to the lime, forming the muriate of lime; while the carbonic acid of the lime, unites to the ammoniac, forming carbonate of ammoniac, which is ſublimed and cryſtalized, on the ſides of the receiver—In paſſing over, the ammoniac diſſolves a portion of the chalk—100 parts contain, 45 acid, 43 alkali, and the remainder chalk and water.

Carbonate of lime, is found cryſtalized by nature; but has never been obtained in cryſtals by art.—It effervesces with acids, forming calcareous ſalts; and the carbonic acid is diſcharged—100 parts contain 55 lime, 34 acid, and 11 water.

Carbonate of barytes, is an inſipid ſubſtance, ſcarcely ſoluble in water—It is decompoſed by heat, and the alkalies; It contains 80 barytes, and 20 acid in 100 parts.

CARBONATE OF MAGNESIA is obtained from epſom ſalt, by adding a carbonate of alkali; cold water diſſolves more than hot—when cryſtalized, 100 parts contain 25 magneſia, 50 acid, and 25 water.

FLUORIC ACID is obtained by diſtilling fluor ſpar, and the vitriolic acid, in a leaden retort: The ſulphuric acid unites with the lime of the ſpar, and forms ſulphate of lime, while the fluoric acid paſſes over in the ſtate of gas, and is abſorbed by water.

This acid has the property of corroding and diſſolving glaſs (Dr. Prieſtly ſays it will corrode a glaſs retort in the ſpace of ten minutes) and has been uſed for the purpoſe of engraving on this ſubſtance, in the ſame manner as the nitric acid is uſed on copper.

From the great affinity between this acid and lime, it may be uſed as a teſt to aſcertain the preſence of it.

FLUATES are formed by this acid and various baſes.

FLUATE OF LIME, or fluor ſpar; this in a moderate heat becomes phoſphoreſcent; it contains 16 acid, 57 lime, and 27 water.

Boracic acid, or acid of borax—If borax be ſublimed with half its weight of ſulphuric acid, a beautiful white powder is obtained, which conſtitutes the boracic acid. Or by adding the ſulphuric acid to a ſolution of borax in hot water, the acid will be depoſited, in ſmall ſcaly cryſtals, on the ſides of the veſſel.

Borates are formed of this acid, with certain baſes.

Borate of soda, or borax—The pureſt comes from China; it is white and tranſparent, is an excellent flux, and uſed in the fuſion of glaſs and the ſoldering of metals.

Borate of potash—This is effected by the direct combination of this acid with potaſh: It cryſtalizes in parallelopipedons.

Borate of ammoniac—This is formed by diſſolving boracic acid in ammoniac, and evaporating until it cryſtalizes.

LITHOLOGY:

OR THE

DOCTRINE

OF

EARTHS AND STONES.

PRIMITIVE EARTHS.

EARTH is an inſipid, inodorous, brittle ſubſtance; white when pure; ſoluble in ſome of the acids, but ſcarcely ſoluble in water. Earths are ſimple ſubſtances, and appear to be nine in number; viz. lime, magneſia, alumine, ſilex, barytes, ſtrontites, jargon of Ceylon, Glucine, and Auguſtine.

LIME.

LIME-STONE, when expoſed to a ſtrong heat, becomes white and brittle; is deprived of its carbonic acid, and is called quick-lime.

To obtain lime in a ſtate of purity, chalk is to be waſhed in boiling diſtilled water; then diſſolved in diſtilled vinegar, and precipitated by the carbonate of ammoniac; the precipitate muſt be calcined, and it is then pure lime. It has a penetrating burning taſte, ſeizes water in large quantities, increaſes in bulk, falls in powder, and emits heat, and light in the dark. It is ſoluble in ſome acids.

Strong nitric acid poured upon lime, has no action on it.

It is ſoluble in 680 times its weight of water: This is called lime-water: It is a good teſt for detecting the carbonic acid, forming the carbonate of lime. If expoſed to the atmoſphere, it will, in a ſhort time, exhibit a pellicle on its ſurface, known by the name of cream of lime: it is regenerated lime-ſtone.

Pure lime, if expoſed to the atmoſphere, abſorbs the carbonic acid, and re-aſſumes its primitive ſtate of mildneſs.

BARYTES,

Or ponderous earth, is never found pure, but combined with the ſulphuric or carbonic acids, forming the ſulphate or carbonate

of barytes. Pure barytes is obtained in the following manner:—The ſulphate of barytes, or ponderous ſpar, is to be pulverized and mixed with a ſmall quantity of charcoal, and expoſed to a red heat for about an hour; the calcined powder muſt be then thrown in water, to which it communicates a yellow colour; and hepatic gas is diſengaged from it: the liquor is then filtered, and a quantity of muriatic acid added, by which a precipitate is produced: this muſt again be filtered, and the liquor holds in ſolution the muriate of barytes. If a ſolution of the mild vegetable alkali be now added, the carbonate of barytes is thrown down, and the carbonic acid muſt be driven off by calcination.

Pure barytes is white; the pruſſiate of potaſh precipitates it from its combinations with the nitric and muriatic acids; this diſtinguiſhes it from other earths. It precipitates alkalies from their combinations with acids.

MAGNESIA

Is a light, ſpongy, white, inſipid, and fuſible earth: It is ſoluble in water, when combined with the carbonic acid; and cold water diſſolves more than hot: It has never

been found pure. To obtain it in a ſtate of purity, take a quantity of the ſulphate of magneſia, or epſom ſalt, and diſſolve it in diſtilled water; to which add the carbonate of potaſh; the ſulphuric acid of the ſulphate of magneſia combines with the potaſh, and the ſulphate of potaſh is held in ſolution, while the carbonic acid of the potaſh unites with the magneſia, and the carbonate of magneſia is precipitated, from which precipitate the carbonic acid muſt be driven off by heat, the remainder is called calcined magneſia.

ALUMINE,

Or pure clay, is found in combination with the ſulphuric acid, and known by the name of alum.—To obtain the alumine pure, diſſolve a quantity of alum in water, to which add a ſolution of potaſh: the ſulphuric acid of the alum, unites with the potaſh, and the pure clay is precipitated in the form of a white powder.—Pure clay ſeizes water with avidity, forming a paſte; it contracts by heat; on this property Wedgwood's thermometer, for aſcertaining the higher degrees of heat, is conſtructed: when baked, this earth ſtrikes fire with the ſteel, and is infuſible by itſelf.

Alumine is capable of an imperfect fuſion, by a current of oxygen gas. Chalk aſſiſts this proceſs : it is fuſible in a crucible of chalk, but not in a common crucible.

SILEX,

Is found nearly pure in rock cryſtal ; to obtain it perfectly ſo, fuſe one part of rock cryſtal with four of alkali ; this muſt be diſſolved in water, and precipitated by an acid. Silex is ſoluble in the fluoric acid, but the fixed alkalies are its true ſolvents, forming thereby glaſs.

This earth is rough, and inſoluble in water ; it is likewiſe infuſible when unmixed.

STRONTITES,

Has been found in the ſtates of a carbonate, and ſulphate. This earth decompoſes all the ſulphates, owing to its ſtronger affinity for the ſulphuric acid.

JARGON OF CEYLON,

Poſſeſſes ſome properties in common with lime and ſilex, it unites with the carbonic,

nitric, and sulphuric acids, but is precipitated from the last by the alkalies.

GLUCINE,

Is a new earth discovered by Vauquelin; it exists in the emerald of Peru, and is found in the beryl, or aqua marina.

It is soluble in the sulphuric acid, and its salts have a sweetish taste.

AGUSTINE,

Is an earth which has received a name, from its salts being tasteless. It is insoluble in water; and the alkalies have no effect on it.

ADAMANTINE SPAR has been supposed to contain a new earth; but from the experiments of Mr. Klaproth, it is found to consist of alumine, from 84 to 89 parts, silex from 5.5 to 6.5, oxyde of iron, from 1.2 to 7.5. It has lately been discovered in the United States.

FIRST CLASS.

SALINE STONES, or the combination of earths with acids, comprehending ſeveral genera.

GENUS I.

Earthy Salts, with a basis of Lime.

SPECIES I.

Carbonate of lime, including different kinds of lime-ſtone, of which there are ſeveral varieties.

VARIETY I.

Calcareous ſpar, preſents a diverſity, in point of figure; the rhomboidal is the moſt common; ſome are pyramidal, as in the hog and dog tooth ſpar. They contain from 34 to 36 of acid, from 53 to 55 of earth, and the remainder water. Theſe ſtones ſometimes contain a ſmall quantity of iron, giving a variety in colour.

VARIETY II.

Calcareous ſtones not cryſtalized—Of this we will make two diviſions; ſuch as admit of a poliſh, and ſuch as do not.

Of the former, are the different kinds of marbles and alabaſters: white marble is the pureſt; as the ancient Parian marble—Black marble is coloured by iron, bitumen, ſchorl, &c. Some are compoſed of the ſhells of animals, united by a calcareous cement; that of Carinthia, forms one of the moſt beautiful.

Alabasters are calcareous ſtones, having ſome degree of tranſparency, cauſing a double refraction.

Such as do not admit of a poliſh, are found in maſſes; as ſtones for building, or in a pulverulent form, as chalk. Theſe are taken up by waters, and depoſited on different ſubſtances, forming petrifactions, or ſtalactites.

If the carbonate of lime be expoſed to a violent heat, it is converted into quick lime; in this caſe, the ſtone is deprived of its water and acid, and a portion of caloric perhaps enters in combination: in this ſtate, the lime is cauſtic; but if expoſed to the air, it again abſorbs what it had loſt, and becomes mild or regenerated lime-ſtone, as we obſerve in mortar, uſed as a cement for building, &c.

SPECIES II.

Sulphate of lime, gypſum, ſelenite, plaſter of Paris, or plaſter ſtone, is found in ſolid maſſes, cryſtalized, ſtalactites, or in the form of gypſeous earth, foſſil flower, &c. having a degree of tranſparency which is loſt by calcination; by this proceſs it becomes pulverulent, abſorbs large quantities of water, and again reſumes its hardneſs, but not its tranſparency. It is found of different colours: the white is moſt eſteemed: 100 parts contain 30 of acid, 32 of lime, and 38 of water.

SPECIES III.

Fluate of lime, or fluor spar—It becomes blue, when heated, and, like common ſalt, decripitates: it is found of different colours, from which it receives the name of falſe emerald, amethyſt, and topaz.

SPECIES IV.

Nitrate of lime exiſts only in waters, owing to its great ſolubility and deliqueſcence.

This ſalt calcined, emits light in the dark, and conſtitutes Baldwin's phoſphorus.

SPECIES V.

Muriate of lime, exiſts in ſea waters, which is ſuppoſed to give the bitter taſte to them. It is deliqueſcent, and when calcined, like the former, becomes phoſphoreſcent, and is called Homberg's phoſphorus.

SPECIES VI.

Phosphate of lime is a whitiſh ſtone of ſome degree of hardneſs—in the fire it emits a beautiful green light—It conſtitutes the baſe of animal bones.

GENUS II.

Earthy salts with the base of barytes.

SPECIES I.

Sulphate of barytes, or ponderous ſpar, is the heavieſt of all ſtones; it is found in plates, applied upon one another, and eaſily ſeparated: when heated it exhibits a blueiſh light in the dark.

SPECIES II.

Carbonate of barytes, this combination is extremely rare—100 parts contain 7 acid, 65 barytes, and 28 water.

SPECIES III.

Nitrate of barytes is not found native. The nitric having leſs affinity for this earth than the ſulphuric and fluoric acids.

SPECIES IV.

Muriate of barytes appears lancellated, and is an excellent teſt for the ſmalleſt portion of ſulphuric acid—It is a production of art.

GENUS III.

Earthy ſalts with a base of magnesia.

SPECIES I.

Sulphate of magnesia or epſom ſalt is found in mineral waters, it cryſtalizes in fine white needles—100 parts contain 24 acid, 19 magneſia, and 57 water.

SPECIES II.

Nitrate of magnesia: this ſalt decompoſes the muriates, and is decompoſed by lime and the alkalies.

SPECIES III.

Muriate of magnesia, exiſts in the mother waters of ſalt works ; it is very bitter.

SPECIES IV.

Carbonate of magnesia is obtained by precipitating epſom ſalt, by an alkaline carbonate.

GENUS IV.

Earthy ſalts with the base of alumine.

SPECIES I.

Sulphate of alumine, or alum, may be formed by digeſting the ſulphuric acid upon clay—It is alſo found native.

SPEICES II.

Carbonate of alumine, is formed by adding, a ſolution of an alkaline carbonate, to a ſolution of alum: the carbonic acid unites to the alum, while the ſulphuric acid unites to the alkali.

The combinations of the other earths are but little known.

SECOND CLASS.

Concerning the mixture of earths.

Earths are found mixed with each other, in large maſſes, having the characters of

the earth which predominates—which we will conſider as ſpecific.

GENUS I.

Calcareous mixtures.

SPECIES I.

Lime-ſtone and magneſia, this combination exiſts in common lime-ſtone.

SPECIES II.

Lime-ſtone and barytes, is found in Derbyſhire.

SPECIES III.

Lime-ſtone and alumine, as the different kinds of marle.

SPECIES IV.

Lime-ſtone and ſilex, conſtitutes the ſtallated ſpar, or ſtern ſchorl: It contains 66 lime, 30 ſilex, and 4 of iron.

SPECIES V.

Lime-ſtone and bitumen, is known by the name of ſwine-ſtone; it emits a fœtid ſmell by friction.

SPECIES VI.

Lime-stone and iron; ſometimes iron exiſts in ſuch large quantities in lime-ſtone as in hematites &c. as to conſtitute iron ore.

GENUS II.

Barytes with other substances.

SPECIES I.

Sulphate of barytes, petroleum, gypsum, alum, and silex, conſtitute liver-ſtone, or lapis hepaticus.—100 parts contain 33 barytes, 5 petroleum, 7 gypſum: 17 alum, and 38 ſilex.

SPECIES II.

Carbonate of barytes, iron and silex, reſemble the ſulphate of barytes.

GENUS III.

Magnesian mixtures.

All the ſtones of this genus are ſoft, or greaſy to the touch, and take a tolerable good poliſh.

SPECIES I.

Carbonate of magnesia with silex and alumine—this mixture forms ſteatites, talcs, pot-ſtones, or lapides ollares. It is white and ſoft, 100 parts contain, 80 ſilex, 17 carbonate of magneſia, 2 alumine, and 1 iron.

Serpentine, contains the ſame ingredients but differing in the proportions.

It is harder than the former, takes a better poliſh, is of different colours, and ſometimes tranſparent.

SPEICES II.

Carbonate of magnesia, *silex*, *lime*, *alumine*, *and iron* : theſe conſtitute aſbeſtos, and mountain cork : aſbeſtos is brittle and rough to the touch, and of a grey colour. Mountain cork, is ſo called from a reſemblance to this ſubſtance.

SPECIES III.

Carbonate of magnesia, *lime*, *sulphate of barytes*, *alumine and iron*: this combination forms amianthus, it is compoſed of flexible threads : this was manufactured into cloth, by the ancients.

GENUS IV.

Mixtures of alumine.

SPECIES I.

Alumine, silex, carbonate of lime, and iron, comprehend all the varieties of clay. They adhere to the tongue, and are uſed for pottery &c.

SPECIES II.

Alumine, pure magnesia, silex, and iron, this combination forms mica ; it is lamellated, ſhining, and of various colours.

SPECIES III.

Alumine, magnesia, silex, lime, and iron, theſe form horn blende. It has a cloſe grain, and a greyiſh black colour.

SPECIES IV.

Alumine, silex, carbonate of magnesia, lime and iron—To this ſpecies belong moſt of the varieties of ſchiſtus or ſlate, as the purple, blue, black &c.

SPECIES V.

Alumine, silex, barytes, carbonate of lime, and magnesia, form another kind of ſchiſ-

tus called pyritous ſchiſtus, when bitumen is preſent in the compoſition, it is called bituminous ſchiſtus.—When bitumen abounds, it forms the different kinds of pitcoal.

SPECIES VI.

Alumine, ſilex, lime and water: theſe form what is called zeolyte, it is white and ſe-mi tranſparent.

GENUS V.

Siliceous mixtures.

All the ſtones of this genus, give fire with the ſteel.

SPECIES I.

Silex, alumine, lime, and iron, intimately combined form all the varieties of precious ſtones or gems.

1. *Red gems*, as *ruby, garnet, &c.*
2. *Yellow do.* as *topaz, hyacinth, &c.*
3. *Green do.* as *emerald, chrysotite, beryl.*
4. *Blue do.* as *ſapphire.*

SPECIES II.

Silex, with a ſmall quantity of *alumine, lime, and iron*, form quartz and rock cryſtal: in this laſt, ſilex is in an almoſt pure

ſtate: It is often tinged with iron, and receives different names, from its colour.

When *Red, false Ruby,*
Yellow, Bohemian Topaz,
Brown, smoky Topaz,
Green, false Emerald,
Blue, water Sapphire,
Violet, Amethyst.

SPECIES III.

Silex, lime, alumine, and iron, intimately mixed, form coarſe and fine flints; as gun-flints, petro-ſilex, agate, calcedony, carnelian, &c.

SPECIES IV.

Silex, alumine, and iron, form jaſpar; this is one of the hardeſt ſtones, and receives a beautiful poliſh.

SPECIES V.

Silex, alumine, lime, and a ſmall quantity of *magnesia,* and *iron,* form ſchorls and volcanic productions. Schorl is found differing in colour, as black, green, violet, &c. The tourmaline ſeems to be a variety of it.

Lava is the principal of volcanic productions; *basalties* is cryſtalized *lava*. *Puzzolano* is the ſame ſtone attenuated.

SPECIES IV.

Silex, *lime*, *magnesia*, *iron*, *copper*, and *the fluoric acid*, forms the chryſoprafe; it is of a greeniſh colour, and extremely hard.

SPECIES VII.

Silex, *blue fluate of lime*, *sulphate of lime*, *and iron*, conſtitute lapis lazuli, or azure ſtone. This ſtone, in powder, forms a valuable blue, known by the name of ultramarine.

SPECIES VIII.

Silex, *magnesia*, *barytes*, and *alumine*, form feld-ſpar; it is white and lamellated, and is one of the conſtituent parts of granite.

METALLIC SUBSTANCES.

METALS are ſimple bodies, diſtinguiſhed by their gravity, opacity, and brilliancy. They are found in the bowels of the earth, in a metallic ſtate, called native or virgin metals; in a ſtate of oxydation, or in com-

bination, as pyrites, &c. All the metals are ſoluble in acids, forming metallic ſalts. We are acquainted with the following—Gold, platina, ſilver, mercury, copper, iron, lead, tin, zinc, antimony, biſmuth, cobalt, nickel, manganeſe, uranite, ſylvanite, titanite, chrome, arſenic, molybdenite, and tungſtinite.

Gold, ſilver, and platina, are conſidered as perfect metals, being more difficultly oxyded than the other metals, which are called imperfect.

OF GOLD.

This metal is of a yellow colour, ductile and tenacious, and generally found pure; it melts at 32° of Wedgwood's thermometer; by a continued heat it is volatilized in its metallic ſtate: the ſulphuric acid has no action on it, but the nitric muriatic and oxygenated muriatic acids diſſolve it. If this ſolution be precipitated by ammoniac, fulminating gold is obtained, in the form of an oxide; this, when gently heated, detonates violently; the oxygen of the gold and the hydrogen of the alkali take fire, and the metal is revived.

Tin alſo precipitates gold from its ſolution; this powder is uſed for painting on

porcelain: and is the purple powder of Caſſius. Gold is alſo ſoluble in the alkaline ſulphurets; it unites with moſt of the metals.

PLATINA

Is of a greyiſh white colour, the moſt ponderous of all bodies; it is found in South America, in ſmall grains, reſiſts the heat of a common furnace, and is ſcarcely altered by a flame of oxygen gas. It is ſoluble in the nitro and oxygenated muriatic acids, from which it is precipitated by the muriate of ammoniac, potaſh, and ſoda. It unites with moſt of the metals. If platina be once fuſed, with the burning lens, or oxygen gas, it becomes as malleable as gold.

SILVER

Is a white ſhining metal, poſſeſſing in an eminent degree, malleability and ductility. It is not oxyded by expoſure to the atmoſphere. By violent heat it is converted into a green glaſs. It is found frequently pure, being called virgin ſilver: It is alſo

found combined with other metals, and frequently mineralized by fulphur, &c. Nitric acid diffolves half its weight of filver, this folution depofits cryftals, which when fufed and caft into moulds, conftitutes the *lapis infernalis*, or lunar cauftic. Copper precipitates filver from all its folutions; in a metallic ftate, prefenting an appearance of vegetation.

If mercury be ufed for this purpofe; the precipitate is called *Arbor Dianæ*. The nitrates of filver and mercury, are good teſts for detecting, the preſence of the muriatic acid. If to the nitric folution of filver, muriatic acid be added, a precipitate is obtained; the muriatic acid unites to the filver, forming a muriate of filver, or luna cornea. Lime-water and the alkalies, alſo precipitates filver from its folutions. If lime-water be added to the nitrate of filver, the filver is precipitated in the ftate of an oxyde. If this oxyde be dried in the air, and mixed with the volatile alkali, it aſſumes a black colour; the fluid muſt then be decanted and the powder dried; this conſtitutes fulminating filver, the moſt dangerous of all fulminating ſubſtances; when once made, it cannot be touched without danger of an exploſion. Only a very ſmall quantity can be made at a time. In this caſe, the oxygen of the filver, unites to the hydrogen of the ammoniac, and pro-

duces water in a ſtate of vapour: the expanſive power of this vapour, with the nitrogen of the ammoniac, are the cauſes of the exploſion; the ſilver being revived.

MERCURY

Is fluid at the common temperature of the atmoſphere; at 39 ° below 0 of Fahrenheit's thermometer, it is congealed, and then in common with other metals, poſſeſſes malleability &c. It boils at the temperature of 600 ° It is of the colour of bright ſilver, and has been found in large quantities in ſouth America, in its virgin ſtate, alſo combined with ſulphur, forming cinabar or ethiops; when bright red, it is called vermilion.

If mercury be expoſed to the air, it is converted into a black powder, called black oxyde of mercury: this is an imperfect oxyde.

If a quantity of mercury be expoſed to the air, in a low degree of heat, for ſeveral months, it is converted into a powder, called red oxyde of mercury, or precipitate per ſe. This gives out its oxygen by heat and the murcury is revived.

Mercury evaporates like other ſubſtances, perſons being ſalivated by breathing

the air of an apartment, in which mercury was expoſed.

If water be boiled upon mercury, a minute portion is taken up—It may be detected by expoſing a piece of gold in it—This mercurial water, has the property of deſtroying worms.

The ſulphuric acid acts on mercury only when aſſiſted by heat; ſulphureous gas, being diſengaged, and a white powder depoſited: this powder is heavier than the mercury made uſe of; if thereon boiling water be poured, it aſſumes a bright yellow colour, called turbith mineral. The French chemiſts are of opinion, that this is an oxyde; Dr. Woodhouſe, on the contrary, ſuppoſes it to be a ſulphate: It however gives out its oxygen by heat.

The nitric acid acts on mercury, without the application of heat, nitrous gas being diſengaged; one part of the acid oxyding the metal, while the other diſſolves it.

Red precipitate is formed by heating the nitrate of mercury in a crucible, or by diſtilling it three or four times with freſh nitric acid. Mercurial water is formed by diſſolving the nitrate of mercury in water. It detects ſulphuric and muriatic ſalts—ſome of the acids, alkalies, earths and metals, precipitate mercury from its ſolution, in the ſtate of an oxyde.

MERCURIUS CINEREUS, or aſh-coloured calx of mercury, is formed by precipitating the nitric ſolution by cauſtic ammoniac.

MERCURIUS FUSCUS, or yellow precipitate, is obtained by adding a ſolution of mild potaſh, to the nitric ſolution of mercury.

MERCURIUS PRECIPITATUS ALBUS, or white precipitate, is formed by precipitating the nitrate of mercury, by the carbonate of ammoniac: It is a carbonate of mercury. The nitric acid, in this experiment ſeizes the ammoniac, while the carbonic acid combines with the mercury.

The carbonate of ammoniac employed in this experiment, muſt be made ſays profeſſor Woodhouſe, by adding to a ſolution of the muriate of ammoniac, the carbonate of potaſh; unleſs this is attended to, the precipitate inſtead of being white, will be of a black colour.

FULMINATING MERCURY: If mercury be boiled with nitric acid, in the proportion of 100 grains, to 12 drachms of acid; and if to this nitrate, 2 ounces of alkohol be added to each 100 grains, and applying a low degree of heat, a powder is depoſited, which when dried, conſtitutes the fulminating mercury: This powder inflames and detonates in vacuo; it explodes by fricti-

on, by the blow of a hammer; by electricity, and by the addition of the ſulphuric acid: In thoſe experiments, the mercury is revived; and the heat produced, is not ſufficient to explode gun-powder.

Muriatic acid, digeſted for ſometime on mercury, oxydes and diſſolves it.

MERCURIUS DULCIS, calomel, or the mild muriate of mercury, may be formed in the dry or humid way. Scheele's method is by adding a ſolution of common ſalt, to a ſolution of nitrate of ſilver—the muriatic acid of the ſalt unites to the mercury, and forms the muriate of mercury, while the nitric acid unites to the ſoda.

It is alſo made by adding the muriatic acid to a nitric ſolution of mercury.

If formed in the dry way, four parts of corroſive ſublimate, and three of quick ſilver, are triturated together, and ſublimed in a glaſs veſſel.

Calomel often contains a ſmall proportion of corroſive ſublimate; to free it from this, nothing more is required, than the addition of hot water; the ſublimate being diſſolved, may be poured off with the water, and the calomel, being inſoluble, remains.

CORROSIVE SUBLIMATE, or the oxygenated muriate of mercury is formed by the

oxymuriatic acid and mercury. This salt is also formed in the dry and humid way. If equal parts of dried nitrate of mercury, decripitated muriate of soda, and sulphate of iron, be rubbed together, and sublimed, a fine corrosive sublimate is formed. Equal parts of common salt and sulphure of mercury, being sublimed, also afford it.

Mercury dissolved in the oxygenated muriatic acid, and evaporated, forms a beautiful corrosive sublimate. It is also obtained by mixing common salt, mercury, and the black oxyde of manganese, and then adding sulphuric acid. The only difference between this salt and calomel is, that it contains a greater portion of oxygen.

Corrosive muriate of mercury is decomposed by the fixed and volatile alkalies, lime, barytes, and magnesia.

If corrosive sublimate be added to lime-water, a yellow precipitate is produced, which is again dissolved: this liquor is called aqua phagedenica.

The acetic acid dissolves the oxyde of mercury, forming an acetate of mercury: This is the base of Keyser's pills.

The boracic acid unites to mercury—If a solution of borax be added to mercurial water, a yellow precipitate is formed, and part remains in solution, which may be obtained by evaporation.

ETHIOPS MINERAL, or the black oxyde of mercury, is formed by triturating 4 parts of mercury and 12 of ſulphur. If ethiops be ſublimed, a ſulphurated oxyde of mercury or cinnabar is formed; which is called vermillion by the painters.

Mercury combines with moſt of the metals, forming amalgams: on this is founded the art of gilding, the working of mines, &c.

Mercury is alſo uſed in thermometers, barometers, and various chemical experiments.

COPPER

Is a red, elaſtic, and ſonorous metal, nauſeous to the taſte, often found native, but generally mineralized by ſulphur, as in copper pyrites; by the decompoſition of theſe, the ſulphate of copper is formed, which is ſoluble in water, and may be detected in ſome mineral waters, by immerſing a piece of poliſhed iron, on which the copper is depoſited in a metallic form.

Sulphuric acid, concentrated, acts on copper, with the aſſiſtance of heat; ſulphureous gas being diſengaged, and the ſulphate of copper is formed: to which if ammoniac be added, the copper is precipitated

and immediately rediſſolved, a beautiful blue colour being produced. This liquor is called aqua cœleſtis, which by evaporation leaves cuprum ammoniacum.

Nitric acid acts violently on copper, nitrous gas and dephlogiſticated nitrous air being emitted.

Muriatic acid does not act on copper, without the aſſiſtance of heat.

Acetous acid corrodes copper, forming acetate of copper, or verdigris.

Ens veneris is made by ſubliming copper and ſal ammoniac.

Aqua Sappharina, may be made by digeſting ſal ammoniac and lime-water in a copper veſſel, or by adding verdigris and ſal ammoniac to lime-water.

Copper combines with ſeveral of the metals. With arſenic it forms tombac, with biſmuth, a reddiſh white alloy; with antimony, a violet alloy; with zinc, it forms Manheim gold; with lapis calaminaris, braſs; with tin, bronze; it alſo unites with gold, ſilver, &c.

IRON

Is of a greyiſh colour: It is the only metal that ſtrikes fire with quartz, or that

is obedient to the magnet. This metal, when expoſed to heat, becomes oxyded, ſeparates in ſcales, and is called finery cinder, which is ſtill attracted by the magnet: when the oxyde is of a black colour, it is called Ethiops martial, or the black oxyde of iron: If this black oxyde be urged by heat, the crocus martis, or ſaffron of Mars, is formed.

Iron burns vividly in oxygenous gas. It contains carbon and oxygen.

STEEL is formed by depriving iron of its oxygen, and combining a greater proportion of carbon, by means of heat.

Caſt or pig iron contains more carbon than ſteel.

Iron and ſteel are fuſible, being then called caſt iron or ſteel.

To convert iron into caſt ſteel, nothing more is neceſſary than to fuſe it with a ſubſtance containing carbon; as charcoal, pitcoal, plumbago, carbonate of lime, &c. about 1 part of carbon to 90 of iron, is ſufficient to make the beſt caſt ſteel. It was formerly made by fuſing ſteel of cementation, but it is now proved that malleable iron, and even iron ore, anſwers the ſame purpoſe.

Sir Thomas Frankland aſſerts, that caſt ſteel and common ſteel, or iron, will unite; the former in a white, the latter in a wel-

ding heat: But the fact is, that if a white heat be given to caſt ſteel, it is converted into iron. From the information of perſons of veracity, I am induced to believe, that if the two unite, it muſt be by giving a cherry red to the caſt ſteel, and a welding heat to the iron; then gently hammering them together; after which they are again to be heated cherry red, and hammered until they become black.

Iron combines with ſulphur, forming martial pyrites, or ſulphurets of iron: in this manner pyrites are formed in the bowels of the earth. It is by the decompoſition of theſe, that the formation of ſulphate of iron muſt be accounted for.

COLCOTHAR OF VITRIOL is formed by calcining the ſulphate of iron, thereby driving off the water and acid.

INK is made by mixing the ſulphate of iron and powdered galls in water, the iron is precipitated by the gallic acid.

The common ſulphate of iron conſiſts of two ſalts, the green and red ſulphate: the former is ſoluble in alkohol, but the latter is not.

If diluted ſulphuric acid be added to iron, the water is decompoſed; its oxygen oxydes the metal, while its hydrogen is diſengaged;

and the acid diſſolves the oxyde—forming ſulphate of iron by cryſtalization.

The nitric acid acts on iron—If more iron be added to a ſolution already ſaturated, the acid throws down the oxyde, and attacks the iron.

The muriatic acid acts on iron, when diluted, with violence; producing hydrogenous gas.

PRUSSIAN BLUE is formed by diſſolving iron in the pruſſic acid.

ZWELFER'S SAFFRON OF MARS, is formed by detonating equal parts of ſteel filings and nitre in a crucible.

ENS MARTIS, flores martiales, or martial flowers, is formed by ſubliming one pound of muriate of ammoniac, and one ounce of ſteel filings.

Iron diſſolved in the acidulous tartrite of potaſh, forms the ſoluble martial tartar, or aperitive extract of Mars.

The carbonic, phoſphoric, fluoric, acetic, and pruſſic acids, all unite to iron, forming different combinations.

Iron is found in plants, and in animal fluids.

LEAD

Is the ſofteſt, leaſt ſonorous, leaſt tenacious, leaſt elaſtic, and one of the heavieſt and moſt fuſible of the metals. It is of a blueiſh white colour.

Lead is generally found mineralized with ſulphur, and is then called galena: if this metal be kept in fuſion, for ſometime, its ſurface is converted into a grey oxyde: this oxyde when expoſed to a greater heat, becomes yellow, and is called maſſicot: If the heat be continued, it is changed into a red oxyde or minium. This oxyde is 10 per cent heavier than the metal uſed.

If a ſtream of freſh air be directed over lead in fuſion, a ſcaly oxyde is obtained called litharge.

The oxydes of lead afford oxygenous gas by diſtillation.

The muriatic acid diſſolves lead; this muriate of lead, by calcination, affords a powder of a yellow colour, called patent yellow. This is alſo made by fuſing in a ſtrong heat, an oxyde of lead, and common ſalt.

The acetic acid, corrodes lead and affords a white oxyde, known by the name of white lead. Ceruſe is a mixture of white lead and chalk.

SUGAR OF LEAD, is formed by diſſolving white lead in vinegar, the ſolution being concentrated, forms efflorescent cryſtals.

If a piece of zinc be ſuſpended in a ſolution of ſugar of lead, the lead is revived, and adheres to the ſurface of the zinc, forming the leaden tree.

GOULARD'S EXTRACT, is a ſolution of ſugar of lead in vinegar.

The oxydes of lead, are uſed to render oils drying; this is effected by giving out their oxygen to the oils.

If paper be written on with a ſolution of ſugar of lead, it will be inviſible, but if expoſed to ſulphurated hydrogen gas, it becomes black.

TIN

Is the lighteſt and moſt fuſible of all the metals; it is ſoft and of a ſilver white colour; emits a crackling noiſe when bent, which is called the cry of tin: This has been attributed to arſenic; but ſome late experiments on Malacca, and Banca tin have proved the contrary.

If tin be kept in fuſion, and the ſurface expoſed to the air; it is converted into a

grey oxyde, which by more heat, becomes a white and perfect oxyde, called putty.

If melted tin, be triturated in a mortar till it cools, it is called pulvis ſtanni.

The muriatic acid, diſſolves tin.

THE FUMING LIQUOR OF LIBAVIUS, is made by diſtilling an amalgam of tin and mercury, and the ſame quantity of corroſive ſublimate; an inſipid liquor accompanied with white vapours comes over: It is an oxygenated muriate of tin.

Highly concentrated nitric acid, has no action on tin, but if diluted, the water is immediately decompoſed, its oxygen converts the metal into an oxyde: part of the acid ſeizes this oxyde, and forms with it a nitrate of tin; while the hydrogen of the water unites to a part of the azote of the acid, and forms ammoniac; this is ſeized by another portion of the nitric acid, and is converted into the nitrate of ammoniac; the laſt portion of the nitrogen and oxygen of the nitric acid, unite, and form the nitrous gas, and the nitrous oxyde, which are given over during the proceſs.

Tin diſſolved in the diluted nitric acid, is uſed for the compoſition of ſcarlet dye from cochineal.

AURUM MUSIVUM, or Moſaic gold, is a ſulphure of tin, it is formed by amalgama-

ting 8 ounces of tin, and mercury; this is put in a matrafs with 6 ounces of fulphur, and 4 of fal ammoniac, which muft be expofed to heat: If the heat is fuch as to inflame the mixture, it is fublimed of a dazzling colour. In this procefs the tin is oxyded by the muriatic acid of the fal ammoniac: The hydrogen of the water of the fal ammoniac, unites with the fulphur, forming fulphurated hydrogen gas. The muriated oxyde of tin, and mercury, united with fulphur, forming cinnabar, alfo rifes; the remaining oxyde of tin and fulphur, forming the aurum mufivum.

An amalgam of tin and mercury is ufed in making looking-glaffes.

A mixture of 3 parts of tin, 5 of bifmuth, and 2 of lead, form an alloy, fufible at the temperature of boiling water.

An excellent amalgam, for exciting the electrical machine, is made by melting together 1 part of zinc, 1 of tin and 2 of mercury.

Pewter is a mixture, of tin, lead, and antimony.

Tin is ufed for tinning copper veffels. It is ufed alfo in enamelling, in the compofition of bronze, &c.

ZINC

Is of a whitiſh blue colour; when heated to redneſs, it ſublimes in the form of a white powder called flowers of zinc, pompholix, &c. It is an oxyde, and is acted on by all the acids. If diluted ſulphuric acid be uſed, the water is decompoſed, its oxygen oxydes the metal, while the acid diſſolves it, forming white vitriol; and the hydrogen eſcapes.

The nitric and muriatic acids act on zinc, forming the nitrate or muriate.

Zinc combines with moſt of the metals, with copper it forms tombac, prince's, and Pinchbeck's metal, ſimilor, &c.

LAPIS CALIMINARIS, is an oxyde of zinc.

ANTIMONY

Is a white ſemi-metal of a brilliant colour, difficult of fuſion; when melted, it ſublimes in the form of a white powder, called flowers of antimony.

Antimony is uſually found combined with ſulphur: The ſulphur driven off by heat, leaves the metal after fuſion in the ſtate of a regulus. By calcination the reg-

vlus is converted into a grey oxyde, which being urged by heat, is changed into a reddiſh ſemi-tranſparent glaſs, called glaſs of antimony. This mixed with wax, conſtitutes the cerated glaſs of antimony.

Kermes mineral, or the ſulphurated oxyde of antimony, is obtained by boiling the ore of antimony in a pure alkaline ſolution; after which the fluid is filtered, and the kermes is precipitated by cooling. It is alſo made by digeſting pulverized antimony in lime-water. The golden ſulphure of antimony only differs from it in colour.

If the ſulphuric acid be poured on antimony, ſulphureous gas is obtained, and the ſulphur ſublimes, leaving a metallic oxyde with a ſulphate of antimony.

The nitric acid acts on this metal; the oxyde thus prepared, is a true bezoar mineral.

Muriatic acid long digeſted on antimony, acts partially on it.

If 2 parts of corroſive ſublimate, and 1 of antimony, be diſtilled together, the butter or ſublimed oxymuriate of antimony is obtained, which eaſily cryſtalizes: it is a violent cauſtic. If water be added to this oxymuriate, a powder is precipitated, called the powder of algaroth, or mercurius vitæ.

Water acts on this metal, contracting a purgative quality.

ANTIMONIAL WINE, is prepared by digesting the glass of antimony, or crocus metallorum in wine. It is dissolved in proportion to the acidity of the wine.

THE PERPETUAL PILL is antimony cast in that shape; the gastric juice acts on it.

TARTAR EMETIC or the antimoniated tartrite of potash, is formed by the glass of antimony, or the crocus metallorum, and the acidulous tartrite of potash, boiled in equal quantities with water; by filtration and evaporation, over a gentle heat, crystals are obtained.

DIAPHORETIC ANTIMONY is formed by detonating equal parts of nitre, and the regulus of antimony.

CROCUS METALLORUM is prepared by deflagrating the sulphure of antimony and nitre in an ignited crucible. This sulphurated oxyde of antimony must be pulverized and washed.

JAMES'S POWDER, is a composition of antimony and the phosphate of lime.

Antimony unites with ſeveral of the metals; with iron, it is called regulus martialis; with copper, regulus veneris, &c.

BISMUTH,

Or tin glaſs, is of a white, yellowiſh colour, brittle, and the moſt fuſible of all the ſemi-metals.

When fuſed, it ſublimes in the form of a yellow powder, called flowers of biſmuth; which acquire 12 per cent in weight.

Biſmuth is ſoluble in all the mineral acids, from which by the addition of water, a white powder falls down called the magiſtery of biſmuth, pearl white, face white, &c. it is uſed by the ladies as a pigment for the face, but like all metallic pigments, is a bad one, being turned black, by ſulphurated hydrogen gas.

The various ſolutions of biſmuth in acids, conſtitute ſympathetic ink.

This ſemi-metal unites with all the metals, but difficultly with the other ſemi-metals.

It amalgamates with mercury forming a fluid alloy.

They are frequently mixed by the druggiſts: but the fraud may be detected by diſ-

folving the mixture in the nitric acid; the magiſtery of biſmuth will be produced.

COBALT

Is a ſemi-metal, of a grey or whitiſh blue colour; it is generally found combined with arſenic; when cleared from this, it is known by the name of zaffer; this oxyde fuſed with 3 parts of ſand, and 1 of potaſh, forms a blue glaſs, which, when pounded and ground in a mill, is called ſmalt, the fineſt particles waſhed off by water, are named azure; it is uſed in the preparation of clothes, and laundreſſes uſe it as they do Pruſſian blue. It is uſed in painting on porcelain, pottery, &c. This ſemi-metal is ſoluble in the acids. With muriatic, and nitro-muriatic acids it forms a very ſingular ſympathetic ink.

NICKEL

Is of a greyiſh colour, difficult of fuſion, ſoluble in the mineral acids, and generally found combined with arſenic and iron. The arſenic is ſeparated by repeated calcination.

The ſulphuric acid diſtilled on nickel affords ſulphureous acid; the reſidue communicates a green colour to water. It does not amalgamate with mercury.

MANGANESE

Is of a blackiſh colour, and always found in the ſtate of an oxyde, more or leſs perfect, from which the metal has been obtained by Mr. Ghan. This oxyde affords large quantities of oxygenous gas by heat only. If 1 part of the oxyde of manganeſe and 3 of nitre, be put in a crucible and expoſed to heat, camelion mineral will be formed. Scheele has proved that the aſhes of vegetables contain manganeſe: to this the blue colour of calcined potaſh has been attributed.

This ſemi-metal is more fuſible than iron.

The oxyde of manganeſe diſtilled with charcoal affords the carbonic acid, and unites eaſily by fuſion, with all the metals, except mercury. The ſulphuric acid attacks manganeſe, and produces hydrogen gas.

The nitric acid diſſolves manganeſe with effervescence.

The muriatic acts on the metal, but when digeſted on the oxyde, it ſeizes the

oxygen, and is converted into the oxygenated muriatic acid.

The oxyde of manganeſe is uſed to deprive glaſs of its green colour; hence the term glaſs makers ſoap. It gives a violet colour to glaſs and porcelain.

ARSENIC

Is generally found in the ſtate of an oxyde, it is brittle, white, and ſoluble in water; exhaling an odour of garlic, when expoſed on hot coals.

By fuſion it unites with metals, rendering them brittle.

The oxyde of arſenic united with ſulphur forms orpiment or realgar: the only difference is in the colour, which only depends on the degree of heat uſed: They are found native in different parts of the world.

If equal parts of orpiment and corroſive ſublimate, be diſtilled together, a black liquor comes over, called the ſublimed muriate, or butter of arſenic.

The arſenical acid is obtained by diſtilling 6 parts of nitric acid, and 1 of the oxyde of arſenic. This acid is obtained in a concrete ſtate, but attracts the humidity of the atmoſphere.

Arſenic is uſed as a flux in glaſs-houſes, and is alſo uſed by dyers. Orpiment and realgar are much uſed by painters.

MOLYBDENA

Has long been taken for black-lead ore; but is a ſemi-metal of ſome degree of brilliancy: It is compoſed of ſcaly particles, ſlightly adhering to each other.

It is oxydated in a ſtrong heat; the concentrated ſulphuric acid diſſolves a great quantity of it. The molybdic acid is obtained in the ſame way as the arſenical.

Wolfram, tungſtinite, titanite, ſylvanite, or telurite and uranite, are ſemi-metals, of which we know but little more than the names.

VEGETABLE KINGDOM.

VEGATABLES are organized living beings, endowed with irritability, and probably with the power of ſenſation. To theſe may be added, digeſtive and ſecreting organs, with the apparent faculty of locomotion.

The difference between the vegetable and mineral departments, has been ſatisfactorily eſtabliſhed, by philoſophers: but the limits between the animal and vegetable creation, will, perhaps, never be determined.

Vegetables may be conſidered as the loweſt order of animated beings: like animals, they digeſt their food, and propagate their ſpecies. They will grow and vegetate in air, in which animals have periſhed: This fact evinces that pure air is not neceſſary to their exiſtence. Light is eſſentially neceſſary to them; and they poſſeſs a temperature of their own, at times exceeding that of the atmoſphere.

The conſtituent principles of vegetables are more numerous and complicated than thoſe of minerals. It is therefore evident,

that chemiſts muſt have made leſs progreſs in the former, than in the latter.

Plants are defended with a general covering, analogous to the ſkin of animals; which is divided into three different parts, viz. The external, or cuticle; the cellular or true bark, and the cortical, or liber.

The firſt, or *cuticle*, if detached from the bark is again reproduced, adhering more cloſely to the bark; forming a cicatrix, ſimilar to what takes place when the epidermis of animals has been deſtroyed: it alſo ſerves to defend the plant from external injuries.

The ſecond, or *true bark*, is chiefly compoſed of glands and veſſels; and might be conſidered as the lymphatic ſyſtem: By this, all the ſecretions are performed.

And laſtly, the *cortical;* which appears to be a perfect tiſſue of veſſels, analogous in its functions to the ſyſtem of blood veſſels in animals; and from which the wood is formed.

The bark is the moſt eſſential part of the vegetable: Some plants conſiſt merely of bark, as the gramina, or graſſes.

Trees have frequently been decayed internally, and kept alive by the bark alone.

The wood is formed of concentric layers; the innermoſt are the hardeſt: the external, which are always whiter, are called ſap.

THE PITH is found in the centre of young branches, and diſappears as they grow larger. Vegetables are furniſhed with glands, for the purpoſes of ſecretion.

THE LEAVES perform an important office in the economy of vegetables; they have been compared to the lungs in animals.

The food of plants appears to be various; as water, carbonic acid, &c. From theſe different ſubſtances, the ſap, or blood of the plant, is produced, from which the ſecretions, as gums, reſins, mucilages, &c. are formed.

MUCILAGE is that viſcid ſubſtance, which exiſts in ſeeds; as in linſeed, &c. It is in greater quantities in young vegetables; is inſipid, inodorous, ſoluble in water, but not in alkohol, and is one of the nutritious parts of vegetables. Mucilage is abſolutely required for the acetous fermentation. If this ſubſtance be treated with the nitric acid, the oxalic will be formed; and if with the muriatic, the citric acid will be produced.

GUMS are inſpiſſated mucus; as the cherry gum: that exuding from other trees, as gum Arabic, gum adragant, &c. They appear to conſiſt of oxygen, hydrogen, carbon, nitrogen, lime, and the phoſphoric acid.

Oil is a combuſtible fluid, and inſoluble in water. There are two kinds of oil, the fixed and the volatile: the former is combined with mucilage, and the latter with aroma.

Fixed oils are obtained by expreſſion, from ſeeds, &c. they combine with alkalies, forming ſoap. Fine white ſoap is made from tallow and ſoda; and the ſoft ſoap from whale-oil and potaſh.

Fixed oils are inſoluble in alkohol: They afford, by diſtillation, phlegm, acid, a light oil, hydrogen gas, and carbonic acid. By the combuſtion of oils, lampblack, or the charcoal of oils, is produced.

Volatile oils are obtained by diſtillation and expreſſion; they are ſlightly ſoluble in water, and entirely ſo in alkohol and acids: they have a greater affinity with oxygen, than fixed oils—forming reſins.

Some of the eſſential oils inflame, by the addition of the nitric acid. Dr. Mitchill has taken notice of this in an elegant manner, in the following verſes:

You ſaw, that time, terrific anger boil,
When aqua fortis met with heated oil;
Both vanquiſh'd, falling underneath the ſhock,
Expir'd in blaze and ſuffocating ſmoke!!!

STARKEY'S SOAP is made by triturating 10 parts of cauſtic alkali, with 8 of the oil of turpentine, together, in a hot mortar.

RESINS are oils rendered concrete, by the abſorption of oxygen: They are inflammable, inſoluble in water, and ſoluble in alkohol. The pureſt are, the balm of Mecca, or Judea, tacamahaca, elimi, ſanguis draconis, &c.

VARNISH is made by diſſolving reſin in different ſubſtances. There are three kinds of varniſh; the fat oil, eſſential oil, and ſpirit varniſh, The fat oil varniſh is reſin, diſſolved in drying oil; eſſential oil varniſh is a ſolution of reſin in oil of turpentine, &c. ſpirit varniſh is made by diſſolving reſin in alkohol. Oil of turpentine is generally added to fat oil varniſh, to promote its drying; and to ſpirit varniſh, to prevent its cracking.

The beautiful black varniſh of the Chineſe is obtained from a tree, by inciſions.

GUM RESINS ſeem to conſiſt of an extractive matter and reſin: they are partly ſoluble in water, and in alkohol; as the frankincenſe, ſcammony, gum gutta, aſſa fœtida, &c.

BALSAMS are reſins combined with aroma; they contain a principle, which by

combining with oxygen, forms an acid: under this head are placed, benzoin, balſam of Tolu, ſtorax, &c.

Gum elastic is obtained from a tree of South America, called caoutchouc, by inciſions being made in it. It is applied on moulds of clay when ſoft, and afterwards dried. It is inſoluble in water or alkohol; and is only diſſolved in the nitric ether.

Camphor is a gum reſin, obtained from a ſpecies of laurel—the laurus camphora. It grows in China and Japan. Camphor may be obtained, in ſmall quantities, from thyme, ſage, roſemary, ſaſſafras, &c. The roots are generally uſed, from which the camphor is obtained by diſtillation. This is called crude camphor; which muſt be purified by ſublimation.

The reſin poſſeſſes the greateſt virtue, and is taken up by alkohol.

Fecula of vegetables appears to be mucilage ſomewhat changed; it is inſoluble in cold water, but when diſſolved by hot water, it reſembles mucilage: Leguminous vegetables contain the moſt of it. It is obtained by bruiſing the plant in water: by this proceſs, the fecula will be depoſited.

In this manner is prepared ſtarch, caſſava, ſalep, indigo, ſago, &c.

VEGETABLE GLUTEN, or the materia vegeto-animalis, having ſome of the properties of animal ſubſtances, is obtained from wheat, barley, &c. by making a paſte with the powder, and waſhing the fecula from it. This ſubſtance exiſts alſo in opium: it is inſoluble in water: in the fire it burns like an animal ſubſtance, and ſeems to conſiſt of carbon, hydrogen, nitrogen, oxygen, and phoſphorus.

FARINA, or flour, is compoſed of three principles: of fecula, or ſtarch; materia vegeto-animalis, or gluten; and ſugar—each of which is capable of a peculiar fermentation: The fecula undergoes the acetous; gluten, the putrefactive; and the ſaccharine, a vinous fermentation. In the riſing of bread, theſe three proceſſes are combined.

SUGAR is a ſalt, extracted from numerous vegatables by a complicated proceſs. The maple *(acer ſaccharinum)* beets, parſnips, carrots, &c. afford it; but it is obtained in general, and in the greateſt quantity, from the *arundo ſaccharifera*, or ſugar-cane. When purified, it is white, and then called loaf-ſugar; and ſugar-candy, when cryſtal-

ized. It appears to conſiſt of oxygen, carbon, and hydrogen. An acid is extracted from it. *(See oxalic acid.)*

MANNA is a ſugar, ſecreted, by ſeveral vegetables; as the maple, juniper, fig, &c. That of Calabria is the moſt eſteemed.

ALBUMEN exiſts in vegetables, and is obtained from cabbages, &c. It reſembles the ſerum of the blood; coagulating by heat, acids, and alkohol, and being ſoluble in cold water.

VEGETABLE ACIDS

Are all compoſed of carbon, hydrogen, and oxygen; they differ from mineral acids, in being more volatile; and after combuſtion leaving a coaly reſidue.

CITRIC ACID, or acid of lemons, is obtained by ſaturating the juice of lemons with chalk, which forms a citrate of lime; this muſt be waſhed in warm water, to which ſulphuric acid is to be added, ſufficient to ſaturate the chalk; after which, being boiled and filtered, the ſulphate of lime remains on the filter; the liquor is then evaporated, and the acid is obtained in cryſtals.

It may alſo be obtained highly concentrated, by expoſing lemons to the froſt; the aqueous parts congeal, while the acid remains fluid.

It is one of the ſtrongeſt of the vegetable acids, and acts on many of the metals.

MALIC ACID, is obtained from the juice of unripe apples; by ſaturating it with chalk, and adding a ſolution of acetite of lead; the acetic acid combines with the lime, and the lead with the malic acid, which is precipitated; this is to be waſhed in water, and ſulphuric acid added; ſulphate of lead is formed, and the malic acid left pure: It unites with the earths and metals, forming malates.

BENZOIC ACID is formed by boiling together 1 part of lime, 4 of benzoin, and 4 of water, over a gentle fire; the acid unites with the lime, forming a benzoat of lime, this is to be filtered, and muriatic acid added as long as a precipitate continues to be formed; this precipitate is the benzoic acid. If diſtilled with the ſulphuric acid, and the oxyde of manganeſe, it is converted into the acetic acid. Like the former, it unites with earths, alkalies, and metals.

TARTAROUS ACID, or acid of tartar, is obtained from tartar, by diſſolving it in water, and ſaturating it with chalk; a tartrite of lime is precipitated; to this the ſulphuric acid muſt be added, and the tartarous is ſet at liberty and is obtained by evaporation and cryſtalization. If this acid be boiled with the ſulphuric, it is converted into the acetic acid; the taſte of this acid is very ſharp. By the addition of ſoda, ſal rochelle or ſeignette is formed.

OXALIC ACID, or acid of ſugar; is generally obtained from the ſalt of ſorrel, which is the juice of the oxalis acetoſella.

It may be obtained by treating 1 ounce of loaf-ſugar, with 4 ounces of nitric acid; a low degree of heat is then to be applied, until nitrous gas ceaſes to come over, the heat is then to be increaſed and the liquor evaporated and cryſtalized. It is an excellent teſt for detecting the preſence of lime.

CAMPHORIC ACID, is obtained in the ſame manner as the oxalic; it acts on copper, iron, zinc, arſenic, &c.

GALLIC ACID, is obtained from bark, roots, &c. or by infuſing nut galls in water, and filtering it; after ſtanding, a pre-

cipitate is depoſited, which, being diſſolved in boiling water, and evaporated by a gentle heat, depoſits fine ſandy cryſtals, which conſtitutes the gallic acid: It is acid and aſtringent to the taſte. It effervesces with alkalies, and reddens litmus. It precipitates ſeveral of the metals: Iron of a black; lead, of a white; copper, of a brown; ſilver, of a grey; and mercury of an orange yellow colour.

TANNIN is that principle which combines with the gelatinous parts of animals, in the proceſs of tanning: It is found in the bark and ligneous part of vegetables, generally accompanying the gallic acid.

SUBIREC ACID, or acid of cork, is bitter and pungent, and if expoſed to the air, aſſumes a browniſh colour: It unites with lime, potaſh, magneſia, alumine, &c.

EMPYREUMATIC ACIDS.

Theſe acids are three in number.

PYRO-TARTAROUS ACID, is obtained, by diſtilling dry tartar. Its combinations are called pyro-tartrites.

PYRO-MUCUS ACID, is obtained by diſtilling ſaccharine, gummy, or farinaceous

mucilages: It communicates a reddiſh colour to the ſkin, diſſolves iron, tin, and copper; corrodes lead, &c.

PYRO-LIGNOUS ACID, is obtained by diſtilling wood: hard wood, as beech, &c. affords the largeſt quantities: It reddens the blue vegetable colours, does not precipitate iron; unites with alkalies and earths: Its action on metals is ſimilar to the acetous acid.

VEGETABLE FERMENTATION

Never takes place, without the preſence of oxygen; It is afforded by the atmoſphere, or the decompoſition of water. In this proceſs heat is generated.

Fermentation is of three kinds, the acetous, the vinous, and the putrefactive. If mucilage is abundant, the acetous takes place—if ſugar abounds, it is termed vinous; and if gluten predominates, the putrefactive fermentation reſults.

ACETOUS FERMENTATION: for this proceſs, it is neceſſary that oxygen, a certain degree of heat, and mucilage be preſent. When fermentation commences, the maſs or liquid, becomes warm, and turbid at-

moſpheric air is abſorbed, and a ſediment falls to the bottom: the liquor then becomes clear, emits a lively ſmell, and is acid to the taſte.

If wine, beer, or cider, are ſuffered to ferment too long; or too much heat be applied, it paſſes from the vinous, to the acetous fermentation, forming vinegar. Spirit of wine, mucilage, and air, are required in the formation of vinegar.

Vinegar thus obtained, is concentrated by diſtillation, and is then called acetous acid.

The combination of this acid with potaſh, forms the acetite of potaſh, or terra foliata tartari; with ſoda, an acetite of ſoda; with ammoniac, ſpiritus mindereri.

The oxygenated acetous acid, radical vinegar, or acetic acid, is formed by combining a large doſe of oxygen with the acetous. For this purpoſe, it is diſtilled with the metallic oxydes, or by the ſulphuric acid, and the acetite of ſoda.

This acid forms ſalts denominated acetates; differing from thoſe made by the acetous acid.

The acetic acid, is acrid and volatile, forming ether with alkohol.

It may be procured as ſtrong as the ſulphuric acid.

Combined, with the ſulphate of potaſh it forms the ſalt of vinegar.

VINOUS FERMENTATION, is that by which wine, beer, cider, &c. are obtained; no ſubſtances but thoſe containing a ſaccharine matter, are capable of this fermentation.

By mixing water and ſugar, a rum, or taffia is obtained.

In making wine, the ripe grapes are preſſed, and the juice received in proper veſſels, in which the fermentation is ſuffered to advance—after a few hours, a motion is perceived in the liquor, which gradually increaſes; heat is developed, and the volume of the fluid is augmented, becoming oily and turbid, attended with the diſengagement of carbonic acid: after ſome days, the motion ſubſides; the bulk decreaſes, the liquor becomes clearer, has an agreeable odour, is leſs ſaccharine, and has acquired a reddiſh colour, if made of the red grape. This is owing to the ſpirit diſſolving the colouring matter of the pellicle. The liquor is now decanted and put into caſks, where it undergoes a ſecond fermentation: if this be prevented, the wine will be briſk, as the briſk champaigne, &c. during the proceſs, a ſubſtance is depoſited, on the ſides of the veſſel, called crude tartar. It is purified by waſhing, and boiling it with clay; which when evaporated, and cryſtalized, is called cream of tartar, or the acidulous tartrite of potaſh: ſome wines afford more than others, and the tartar of

red wines poſſeſſes the colour of them. Its taſte is acid and vinous.

Cider, by a ſimilar proceſs, is obtained from the juice of apples; this liquor affords by diſtillation, the ſame product as wine, namely, brandy: Brandy, when obtained in this way, has, a diſagreeable taſte and ſmell, owing to the cider containing a great quantity of mucilage, which is altered by heat in this proceſs.

Perry is obtained from pears.
Cherries afford a tolerable good wine.

Beer is made from certain grains; as wheat, barley, oats, &c. Theſe are moiſtened, and ſuffered to germinate to a certain degree, which is ſtopped by torrefying them: the germination and drying of the grains, deſtroy the gluten, it is then ground into a coarſe meal, and is called malt; on this, warm water is poured, which diſſolves the ſugar and mucilage: In this ſtate, it is called wort. It is then boiled with a quantity of hops, for the purpoſe of obtaining the bitter principle of that vegetable. It is now ſuffered to cool, and a quantity of recent yeaſt added: this ſoon excites the vinous fermentation, which is prevented from going too far, by putting it in caſks, where it throws off a frothy ſcum. The

colour of the beer is owing to the degree of heat applied in drying the malt; when gently heated, pale beer is obtained.

Brandy is usually procured from wine, by distillation.

Rum, from sugar, or the juice of the sugar-cane.

Whiskey, or malt spirit, from the different grains.

Koumiss of the Tartars, is obtained from milk, which has first gone through the acetous, and afterwards the vinous fermentation.

In the vinous fermentation, at the commencement of the intestine motion, atmospheric air is absorbed; this air, as well as the water of the mass is decomposed; a portion of the oxygen unites with the carbon of the saccharine principle, and flies off in the form of carbonic acid: while the hydrogen of the water unites with the remainder of the carbon, and forms alkohol.

Alkohol is an inflamable and volatile fluid, composed of hydrogen and carbon. It is purified by the addition of caustic potash; which combines with the water of the alkohol: a small quantity of the potash is

diſſolved; this is proved by diſtilling it: Ammoniac will be produced in conſequence of the hydrogen of the alkohol uniting with the nitrogen of the alkali. By burning 1 pound of alkohol, Mr. Lavoiſier obtained 18 ounces of water.

Alkohol is the true ſolvent of reſins, eſſential oils, ſoap, &c.

OFFA ALBA HELMONTII is formed by mixing equal parts of alkohol and carbonate of ammoniac; the two inſtantaneouſly unite, in a ſolid form. To ſucceed in this experiment, the veſſel ſhould be colder than the ſurrounding air: By rubbing the veſſel with the hand, it becomes again fluid—This is called *the liquefaction of the blood of St. Januarius!* This pretended miracle is annually exhibited in Naples; cochineal is there added to give it a red colour.

ETHER is oxygenated alkohol; if the oxygenated muriatic acid be paſſed through alkohol, it will be converted into ether, and the acid changed into the common muriatic.

It is commonly obtained by diſtilling equal parts of alkohol and ſulphuric or nitric acids: the carbon of the alkohol unites with the oxygen of the acid, and comes over in the form of ether. If ſulphuric acid be digeſted upon ether, it is, after

ſome time, converted into an ethereal oil, or ſweet oil of wine. Muriatic ether is made by diſtilling a mixture of alkohol, muriatic acid, and the black oxyde of manganeſe together.

Ether is the lighteſt and moſt volatile of all fluids; inſoluble in water; burns with a white flame; has a ſtrong, agreeable, and penetrating odour.

VEGETABLE PUTREFACTION takes place whenever vegetables, impregnated with their juices, are heaped together, and expoſed to the air: the maſs ſoon ſwells; becomes heated; and hydrogen, azote, carbonic acid, with ammoniacal, ſulphurated, and phoſphorated hydrogen gaſſes are given out. After this, the maſs diminiſhes, and is reduced or reſolved into a brown mold, forming an excellent manure.

It appears that a gas may be formed by vegetable putrefaction, deleterious to animals, by producing malignant fevers.

ART OF DYING

Conſiſts in fixing the colouring principle of one body upon another. No proceſs requires more chemical knowledge than

this. We muſt in the firſt place conſider the manner in which colours are formed; the combination of colours, and the beſt means of extracting and obtaining them; and laſtly, the method of applying and rendering them permanent. All bodies in nature poſſeſs the property of abſorbing or reflecting the rays of light, thereby forming the various ſhades.

The art of dying, therefore, conſiſts in changing the ſurface of one body by means of another; ſo that they will both reflect the rays of light alike.

The colouring principle in vegetables exiſts in four different ſtates: with gum, extract, reſin, or with fecula—from which it is extracted by chemical proceſſes. When combined with gum and extract, water is ſufficient to extract it: Spirit of wine diſſolves it, when combined with reſin: when it exiſts with fecula, an alkaline ſolution, or ſolution of lime, diſſolves it: from which combinations they are precipitated by the addition of an acid, on thoſe ſubſtances which are to be dyed. When the colour is of the nature of a gum, and ſoluble in water, it is neceſſary, in order to fix them upon ſtuffs, that they be immerſed in a liquor, called a mordant. Theſe are various; as, the acidulous tartrite of potaſh, ſulphate of alumine, of iron, of copper, of zinc, &c. the nitro and oxygenated muriatic acids,

tin, &c. Theſe are calculated to prevent the colours from being waſhed out. It is requiſite that the mordant have a certain relation with the ſtuff and the colour. Tin is the mordant for ſcarlet, but will not give that colour to ſilk ; and gives no colour at all to cotton.

Indigo, turnſole, rocou, &c. are ſoluble in alkalies and lime.

Indigo is ſometimes diſſolved in the vitriolic acid.

Stuffs to be coloured, are previouſly impregnated with a ſolution of alum, and then dipped in the colouring matter, which renders the blue colour permanent.

Before the application of the colouring principle, it is requiſite to prepare the ſtuffs, by waſhing and boiling them in an alkaline ſolution. The oxygenated muriatic acid is alſo uſed for this purpoſe.

Turnsole is made from a kind of moſs, by putrefaction.

Indigo is obtained from a plant, by bruiſing it in water ; by fermentation the colouring principle, or fecula, is depoſited on the bottom.

Woad is obtained in a ſimilar way.

Sap colours, are extracts of plants.

Alkalies exiſt in vegetables, they are obtained, by lixiviation, from the aſhes.

Plants near the ſea-ſhore, afford ſoda; others potaſh; and ſome, ammoniac; as the horſe-radiſh, muſtard, &c.

Pollen, or prolific powder of vegetables, is of the nature of a reſin: it is inflammable, ſoluble in alkohol, and has a peculiar ſmell.

Wax is a ſolid oil. It appears that wax and the fecundating powder are nearly alike.

Honey, or nectar, is obtained from certain flowers, by bees; it often retains a noxious property, if obtained from poiſonous vegetables. It appears to be a ſolution of ſugar in mucilage.

Aroma, or the fragrant principle of vegetables, exiſts only in thoſe containing an eſſential or volatile oil.

Charcoal, or the oxyde of carbon, is obtained from vegetables, by the proceſs of charring or burning wood, without the free acceſs of air. It is a black, ſonorous, and brittle ſubſtance, inſoluble in water, &c.

Sulphur, *iron*, *gold*, *manganese*, *lime*, *alumine*, *and silex*, are all contained in vegetables.

Opium is obtained from a ſpecies of poppy (the *papaver somniferum;)* it grows in Perſia and Aſia minor: it is extracted from the heads of the plants, by inciſions made into them: the firſt fluid is collected, and affords the pureſt opium; but this is never exported from the country: that which we get, is procured by expreſſion; it is then inſpiſſated, and wrapped up in its own leaves. From ſome late experiments it appears to conſiſt of a gum, a refin, a fecula, and a materia vegeto-animalis, or gluten farinæ.

ANIMAL KINGDOM.

The conſtituent radical principles of animals, are but few; as, carbon, hydrogen, nitrogen, oxygen, lime, and phoſphorus.

Blood, when firſt drawn, is an homogenous fluid; but ſoon ſeparates into two diſtinct parts:—ſerum, and craſſamentum. The ſerum ſwims on the top, and the craſſamentum is compoſed of coagulable lymph and red globules.

Serum is ſlightly ſaline; it coagulates at a moderate degree of heat; alſo, by alkohol and the acids. It yields, by diſtillation, phlegm, carbonate of ammoniac, and a fœtid blackiſh oil; the aſhes of the reſidue afford muriate and carbonate of ſoda, with the phoſphate of lime.

The coagulable lymph of the blood may be obtained by putting a rough piece of wood in blood, when warm, and ſtirring it round; on which the coagulable lymph is collected: It is then to be waſhed in water,

and it presents a fibrous texture, has no smell, is insipid, and easily putrefies.

Red globules contain a large quantity of iron: If dried blood be burned, an oxyde of iron is obtained, obedient to the magnet.

Gastric juice is secreted from the stomach: by this the food is dissolved. It yields in distillation, phosphates, water, and gelatin.

Pancreatic juice, and saliva, appear to be nearly the same.

Milk is secreted by that order of animals called mamalia: It is a white, sweet, and oily fluid; when exposed to the air, cream is observed on its surface: In a short time it becomes sour and separates into two distinct parts—coagulum and whey.

Serum lactis or whey, may, by several processes, be made to pass into the vinous fermentation, and affords alkohol, vinegar, &c.

Coagulum contains two substances—cheese and butter; cheese is obtained by suffering it to undergo the putrefactive fermentation. It is then dried, and acquires a proper consistence.

Butter is produced from the cream, by agitating it: The remainder is called butter-milk. Butter, by diſtillation, yields water, the ſebacic acid, and a coloured oil.

Lactic acid or acid of milk; by evaporating ſour milk, then adding lime water to the reſidue, a precipitate is obtained; and the lime combines with the acid: The oxalic acid, is then added, which combines with the lime, forming an oxalate of lime, which is inſoluble; and the acid remains in the fluid; this is evaporated to the conſiſtence of an extract, to which alkohol muſt be added; this combines with the acid; it is then filtered, and the lactic acid is obtained by diſtillation.—This acid, unites with earths, alkalies, and metals.

Sugar of milk is obtained by evaporating whey to the conſiſtence of honey. It is then dried in the ſun, afterwards waſhed and diſſolved in water, and ſuffered to cryſtalize.——It has all the appearances of ſugar: by the nitric acid, it is converted into the oxalic.

Saccholactic acid, is obtained in the proceſs of making oxalic acid, from ſugar of milk; it is ſoluble in ſpirit, but not in water; is combuſtible, but leaves no reſidue, ſour to the taſte, and reddens litmus.

Fat is a condenſed oil, conſiſting of carbon, hydrogen, and the ſebacic acid. It is generally white, or yellowiſh; and is obtained pure, by boilving it in water. It has more conſiſtence in ſome animals than others. It has all the characters of oil, being inflammable, forming ſoap, &c.

Sebacic acid, or acid of fat is obtained by diſtilling fat, on the water bath, or with a low degree of heat. It is alſo obtained by diſtillation from ſpermaceti.

It appears to exiſt ready formed in fat, and unites with metals earths, &c.

Bile is a fluid ſecreted by the liver, it is of the conſiſtence of an oil, of a greeniſh colour, intenſely bitter, and forms a froth by agitation, like a ſolution of ſoap. It has been ſuppoſed to be ſaponaceous, but this is denied by my ingenious friend Dr. Roebuck, in his inaugural diſſertation printed at Philadelphia in 1801. By diſtillation it affords a water or phlegm, impregnated with a ſpiritus rector or aroma, and a quantity of fixed oil. The reſidue contains the phoſphates and muriates of lime and ſoda. Iron has been ſuppoſed to exiſt in the bile, but ſome late experiments render this doubtful.

GELATIN, or jelly, is obtained, by boiling animal ſubſtances, ſuch as bones, cartilages, tendons, ſkin, &c. It is inſipid, inodorous, ſoluble in water, but not in alkohol: It ſoon putrefies, giving out hydrogen, azote, and carbonic acid: It is alſo ſoluble in acids, and alkalies; with nitric acid, it affords nitrogen gas: This ſubſtance made into cakes and dried, forms the portable ſoup: In a ſimilar manner glue is obtained. The ſtrongeſt glue is obtained from the ſkins of old animals.

Gelatin by diſtillation, affords a phlegm, with additional heat, it becomes black, ſwells up and emits a ſtrong ſmell; an alkaline phlegm, empyreumatic oil, and carbonate of ammoniac, then come over: The reſidue affords muriate of ſoda, and phoſphate of lime.

THE MUSCULAR PARTS of animals yield by diſtillation an alkaline phlegm, which ſoon putrifies, empyreumatic oil and carbonate of ammoniac. From the reſidue, fixed alkali, and muriate of potaſh are obtained. By the adddition of the nitric acid, much nitrogen comes over. It alſo affords oxalic and malic acids, when treated with the nitric.

The muſcular parts of animals when buried for a certain time under ground; afford a ſubſtance, ſimilar to ſpermaceti.

URINE, is a fluid ſecreted from the blood by the kidneys: It is ſaline to the taſte, of a pale yellow colour, and has a peculiar ſmell when freſh; which however is ſoon loſt, and the ſmell of ammoniac is then perceptible: This ammoniacal odour is ſucceeded by one of a very fœtid and offenſive nature.

Urine when recent, contains phoſphoric acid in exceſs, holding a quantity of lime in ſolution. The urine of animals feeding on vegetables, does not contain this acid. Freſh urine, contains no leſs than 11 ingredients viz. urec, the radical or ſpecific matter of urine; ſulphate of lime, of magneſia, of ſoda, and of ammoniac; muriate of ſoda, and of ammoniac; albumen, gelatin; lithic and benzoic acids.

If urine be ſuffered to undergo the putrefactive fermentation, ſome of theſe principles are changed, and new ones formed: the cryſtals of the muriate of ammoniac, and ſoda are altered, and the following ſubſtances are generated: Phoſphate, urate, and carbonate of ammoniac; ammoniaco-magneſian, phoſphate, and ammoniac, united with the acetous and benzoic acids.

CALCULUS OF URINE, is a concrete ſalt, ſoluble in boiling water; which depoſits cryſtals, by cooling; theſe cryſtals conſti-

tute the lithic acid. This acid is alſo obtained by dry diſtillation, being called the ſublimate of Scheele. It may alſo be procured by adding the nitric and muriatic acids to freſh-made urine; reddiſh ſmall cryſtals, are precipitated: This acid is inſipid and inodorous, changes blue vegetable colours, and is ſoluble in cauſtic alkali.

The ſulphuric and nitric acids, act on calculus, but the muriatic acid does not.

It is always diſſolved by the cauſtic alkalies, and precipitated by the acids.

A ſmall quantity of lime, ammoniac, and animal matter is found in its compoſition.

Prussic acid, is that ſubſtance which gives the colour to pruſſian blue.

To obtain pruſſian blue, animal ſubſtances, as horns, hoofs, dried blood, &c. are expoſed to a red heat, with a quantity of alkali: In this proceſs, the alkali unites with the pruſſic acid, of the animal ſubſtance, forming pruſſian alkali. This alkali has the property of precipitating all the metals, from their ſolutions—the alkali unites with the acid, which holds the metal in ſolution, while the pruſſic acid unites to the oxyde, giving it a peculiar colour: Iron, blue; conſtituting pruſſian blue, or pruſſiate of iron: Gold, yellow: Lead, white: Copper, brown, &c.

Pruſſiate of lime or of potaſh, are made by digeſting pruſſian blue with lime, or potaſh: theſe are good teſts for detecting the preſence of iron.

Mucus of the noſe, is a peculiar mucilage, containing muriate of ſoda, phoſphate of lime, and ſoda, in a pure ſtate.

Saliva, is a fluid ſecreted by glands, ſituated in or about the mouth. It is more fluid than mucus, and contains the ſame ſaline principles.

The phoſphate of lime from the ſaliva, is frequently depoſited upon the teeth, and is then called tartar: Similar concretions have been noticed, in the ducts of the ſalivary glands.

Tears are ſecreted by the lachrymal glands. The conſtituent principles are the ſame as ſaliva.

Synovia is a glutinous ſubſtance, found in moveable articulations: It conſiſts of water, carbonate, and muriate of ſoda, with the phoſphate of lime.

Semen, conſiſts of the following principles, water, mucilage, phoſphate, and muriate of ſoda and of lime, and cauſtic ſoda.

Sweat is generally of an acid nature, and probably contains the phoſphoric.

Liquor amnii, is compoſed of albumen, muriate of ſoda, pure ſoda, phoſphate of lime, and water.

Pus, is a ſubſtance ſecreted by the arteries, when freſh it does not appear to differ much from mucus; but undergoes the acid fermentation, while mucus becomes putrid. Some perſons have pretended that they have diſcovered a peculiar acid in pus.

Bones are compoſed of jelly, oil, lime, and phoſphorus. By diſtillation, volatile alkali, Dipple's empyreumatic oil, hydrogen, and carbonic acid are obtained. The reſidue is called ivory black, by the painters.

Enamel of the teeth is the hardeſt part of the animal. It is ſoluble in the nitric acid: this liquor ſaturated with the carbonate of ammoniac, affords a precipitate, which is the phoſphate of lime. The phoſphoric acid, after being diſengaged by the nitric, exiſted in the liquor and ſeized the lime, while the carbonic acid was diſſipated. It is alſo ſoluble in the muriatic acid, without the application of heat.

Zoonic acid is lately found to exiſt in and is to be obtained from animal ſubſtances by diſtillation.

Formic acid or acid of ants, is procured in large quantity, by diſtilling the animals. It is ſoluble in alkohol, and unites with moſt of the metals.

Animal putrefaction, for this proceſs air, heat, and water, are required; the animal ſubſtance, firſt acquires a faint and diſagreeable ſmell, its texture becomes relaxed; its colour, changes to a blue, then green, and becomes ſofter, more fœtid, and aſſumes a brown colour; next a putrid odour manifeſts itſelf, mixed with that of ammoniac: It loſes its conſiſtence; the carbonated phoſphorated hydrogen, together with carbonic acid are ſeparated: It is now changed into a black fœtid maſs, which forms a good manure, when mixed with mould.

In the proceſs of animal decompoſition, the nitric acid is generated by the union of the oxygen of the atmoſphere, with a part of the nitrogen, of the animal ſubſtance; while the hydrogen of the animal fluid, combining with another portion of the nitrogen, forms ammoniac; a portion of the oxygen, unites with the carbon of the fleſh, and forms the carbonic acid, which with a part of the hydrogen, holding phoſphorus in ſolution, are diſengaged.

MINERAL WATERS.

They are ſo termed from their containing mineral ſubſtances in ſolution. They may be divided into four claſſes—*acidulous*, *saline*, *ſulphureous*, and *metallic*.

ACIDULOUS WATERS, have a ſharp penetrating taſte, boil with facility; emit bubbles by agitation, precipitate lime-water, and change blue vegetable colours red. Carbonic acid is generally contained in theſe waters—The ſulphuric acid ſometimes exiſts in them.

SALINE WATERS are characterized by a ſaline taſte; they hold in ſolution ſulphate and muriate of ſoda, muriate, carbonate, and nitrate of potaſh; but moſt commonly ſulphate, muriate and carbonate of lime; ſulphate, and muriate of magneſia, and of alumine.

SULPHUREOUS WATERS have in general a diſagreeable ſmell, reſembling that of rotten eggs; owing to a quantity of hepatic gas held in ſolution, and which is eaſily diſengaged: but the hepar ſulphuris is containd in water, as well as the ſulphurated hydrogen, or hepatic gas.

METALLIC WATERS, are the moſt general, they commonly contain iron, and are then aſtringent to the taſte. The ſulphates of copper, iron, and zinc are occaſionally detected, and ſometimes arſenic.

For detecting the ingredients of these waters, three processes have been instituted, viz. Evaporation, distillation, and the action of chemical reagents. By evaporation alone, the proportions of the ingredients are ascertained. The elastic fluids, by distillation, and by reagents, acids, earths &c.

In Acidulous Waters,

The carbonic acid is detected by lime-water; a white precipitate is formed which is the carbonate of lime. The caustic volatile alkali, is deposited in the state of a carbonate of ammoniac.

Sulphuric acid is detected by the muriate of barytes.

In Saline waters,

Muriate of soda, is detected by the nitrate of mercury.

When the nitrate of silver is used, the muriate of silver, or luna cornea, is precipitated. By the oxalic acid, calcareous salts are detected; an insoluble oxalate being formed.

Corrosive sublimate precipitates pure lime in the form of a yellow powder: caustic potash detects magnesia, with which it forms a white fleaky precipitate. The salts with a base of alumine are detected by the alkalies.

Sulphureous Waters.

Waters which contain sulphurated hydrogen, have their courses marked, by the deposition of sulphur. This is owing to the

hydrogen, which holds the ſulphur in ſolution, forming water on coming in contact with the oxygenous portion of the atmoſphere; and the ſulphur is precipitated.

The ſulphur of hepatic gas, may be precipitated by very ſtrong nitric acid. Arſenic alſo detects the ſulphur, and the acetite of lead forms a browniſh precipitate.

In Metallic Waters,

The gallic acid ſtrikes a black colour with the iron in the water; the pruſſiate of potaſhand lime produces a blue one. When the carbonic acid holds iron in ſolution in mineral waters; it may be driven off, by boiling, and the iron falls to the bottom, in the ſtate of an oxyde.

Sulphate of copper is detected by the volatile alkali, forming the cuprum ammoniacum. By immersing a piece of poliſhed iron in it, the acid unites to the iron and the copper is precipitated on it.

Arſenic is detected by adding the cuprum ammoniacum, forming a greeniſh yellow precipitate, or by evaporating the water, and expoſing the reſidue on burning coals, the ſmell of garlic will be evident.

The reſiduum of evaporation, may alſo be placed between two pieces of copper, and expoſed to heat: the ſurface of the copper will become white.

FINIS.

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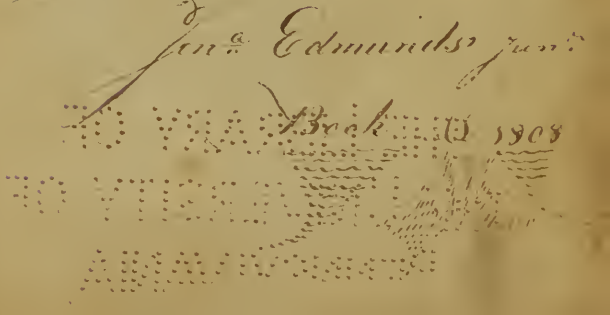
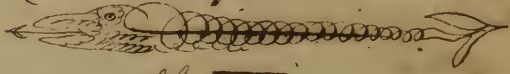


Alconorque Tree.

is a Specific in all diseases of the Liver & Lungs
Its Virtues were communicated by an Indian
of Carraccas. Two Cases are given: ~~One of~~
~~them~~ one of them is signed By P. Badolles
who had been cured of a pulmonary Consumption
pronounced by the Physicians, tubercles on the
Lungs; the other By Don Macias who had been
cured of an abcess on the Liver, which proved
had baffled all the Art of his physicians.
To prepare the dose, he infused 12 oz. of the
Alconorque, (the outer Bark taken off) in
a regular quantity of pure water a Glass
full to be taken next morning & night lukewarm
with two spoon fulls of honey, and to be used
cold as the ordinary drink of the day. 3 Bottles
were used each day divisible in to 8 or nine glasses.
If a great deal of heat is felt on using it barley
water is to be drunk without any acid in it
every Irritating thing is to be laid a side.
Besides this, Don Macias applied a cataplasma to the
Region of the Liver, and the pains instantly abated.
The one being in the most miserable State bringing away
Blood & Pus, 12 Days use of the alconorque effected
a complete Cure, the whole of the abcess being
violently discharged by the mouth.

After the Cure some cooling medi
are to be administered, as the abdomen
is extremly hot

(see N.H. Patriot Oct 30th 1810)



Durable Dyes. from Mrs Grayham.

To dye scarlet. One pound of Madder
Fresh gathered from the garden will dye
pounds of Wool. the wool must be washed clea
then boiled 15 Minutes in strong allum-
water: the Madder is to be boiled in thin
Bran water (the Bran to be carefully
strained from the water, the wool dripped
from the allum Water, and put in the bra
water, must boil 15 or 20 minutes, and
Washed out in Soft Soap suds when cool

by leaving out the allum it dyes a good Brown

To make a Crimson Colour, to 2 Gallons
of Juice of pokeberries, when they are qui
ripe add half Gallon strong Vinegar made
the wild crab apple. to dye one pound of
Wool, which must first be washed very cle
with hard soap. the wool when wrung d
is to be put into the Vinegar & pokeberry Juice, a
simmered in a Copper Vessel for one hour
then take out the wool and let it drip a wh
then spread it in the Sun. The kettle
be free from grease of every kind.

To make an Orange Colour
Take a quantity of Touch-me-not gathered on the Stems. and bruise it well in a morter of Wood-
On Layers of Touchmenot and Wool alternately pour soft Spring or Rain water. untill they are covered let it Stand 24 hours, then have ready a strong Lather of soft Soap. and wash it out and put it immediately in the Sun to dry. Salmon Colour may be made by using hard soap instead of soft these Colours brighten, in Sted of fading, by Washing
Touch-me-not is found in Low places The Stem is pale green. and the flour near of the Color it dyes. it grows as high as 6 feet
(For the above ——— (Su Fr Cabinet Jany 15. 1811)

Cure for Dropsy

Receipt. is — Take two handfuls of the green or inner bark of the white, or common Elder: steep it in 2 qts of white lisbon Wine 24 hours; take a gill of the wine in the morning fasting, or more if it can be borne. or if more convenient part in the morning & part at noon on an empty stomach.

The effect of the bark when prepared as above, or the expressed juice of the full grown which has been used with success where wine could not be had is that it promotes all the animal secretions necessary to health which is the cause of its salutary effect in the dropsy

See — Patriot may 26th 1828 &
Texas so, Hitt N.H. Patriot Oct 5-1841